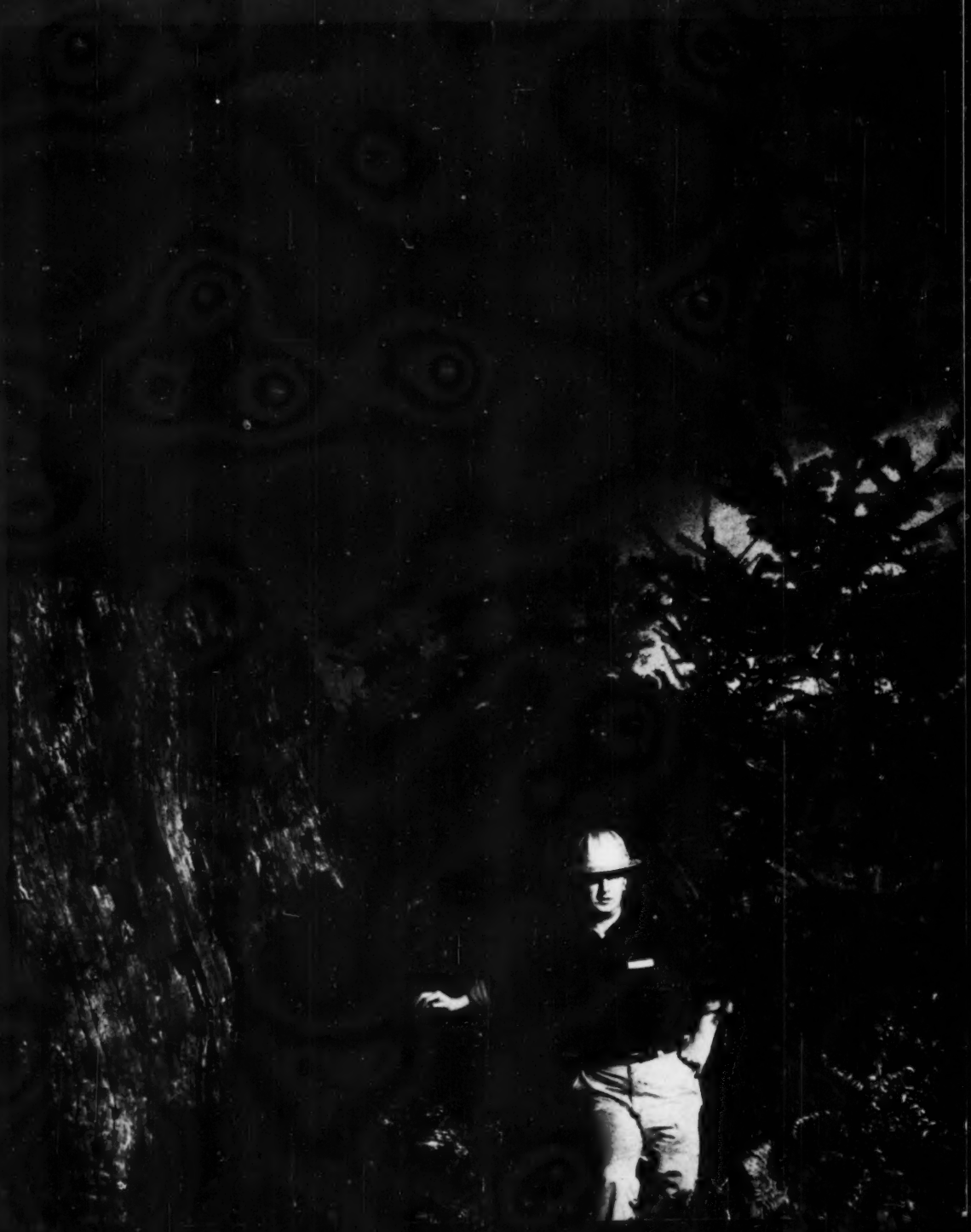
Journal of

FORESTRY

APRIL, 1954



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VOLUME 52 ● NUMBER 4 APRIL 1954

Journal of Forestry

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CONTENTS

COVER: Assistant managing forester William S. Looney looking over second-growth Douglas-fir on the South Olympic Tree Farm.
Photo South Olympic Tree Farm

The South Olympic Tree Farm
Oscar R. Levin 243

The Role of Surveys in Forest-Insect Control
L. W. Orr 250

Eradication and Thinning Tests for Nectria and Strumella Canker Control in Maryland
Elmer R. Roth and *George H. Hepting* 253

Growth Versus Allowable Cut
Paul C. Guilkey 257

Physical Changes in Decaying Wood
D. B. Richards 260

Poisoning Versus Girdling to Release Underplanted Pines in North Mississippi
B. J. Huckenpahler 266

Anatomy and Morphology of the Seedling Roots of Four Species of the Genus Quercus
I. W. Carpenter and *A. T. Guard* 269

Growth of Pond Pine in a Pocosin Area
Clemons M. Kaufman, John B. White and *Robert J. Monroe* 275

Notes 279

Abstracts from an Address on Multiple Use of Forests; South Carolina Sand Hills Can Grow Pine Timber; The Forest Service of the Republic of Turkey; Mettler's Woods; Comments on "White Hollow Watershed Management;" Using the Climbing Rope and Saddle in Forestry; Comments on "Calculator Interpolations."

Reviews 287

Conservation Law and Administration; Woodworking for the Home Craftsman; Timber: Its Structure and Properties; The University of the South Forest; The Biltmore Immortals; Incredible Seney; Wildlife Management: Fur Bearers, Waterfowl, and Fish; Lespromkhoz as an Administrative and Production Unit; Vegetation and Watershed Management; Publications of Interest.

Current Literature 296

Society Affairs 297

Forestry News 307

Index to Advertisers 315

Directory 316

Division and Section Officers; Committees and Representatives; Colleges and Universities in the United States Offering Instruction in Forestry.

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Journal of Forestry

Official Organ of the Society of American Foresters

The South Olympic Tree Farm

Oscar R. Levin
Managing Forester, South Olympic Tree Farm Company, Shelton, Wash.

The evolution and administration of a large commercial tree farm are described in this article. It is an example of long range planning that integrates management of several ownerships into a productive forest unit, and is a type of undertaking of great import to future management of privately owned forest lands.

In April 1943, the Simpson Logging Company made application to the Joint Committee on Forest Conservation of the Pacific Northwest Logger's Association and West Coast Lumbermen's Association for certification of the company's second growth lands as a tree farm. On July 8, 1943, Certificate 15 was issued, the area to be known as the South Olympic Tree Farm. Shortly thereafter, Simpson was joined by the Weyerhaeuser Timber Company and the Milwaukee Land Company, and jointly incorporated as a non-profit organization under the laws of the State of Washington as the South Olympic Tree Farm Company.

The member companies jointly listed 140,000 acres within a boundary area of 250,000 acres, located in eastern Grays Harbor County, western Mason County and northwestern Thurston County; or more generally, in western Washington on the south part of the Olympic Peninsula between Puget Sound and Hood Canal on the east, and westward to the Wishkah River, or approximately 25 miles inland from the Pacific Ocean.

The original acreage has been enlarged through acquisitions by the member companies and by new members to more than 176,000 acres within the present boundary area of 350,000 acres.

Assessed Acreage, 1953

Simpson Logging Company	115,000
Weyerhaeuser Timber Company	59,180
Milwaukee Land Company	2,349
Mrs. Dorothy White Simms	5
Bruce Elmore	110
	176,644

The purpose of the tree farm is to secure, foster, and advance the reproduction of forest growth; to protect the regrowth from damage by fire, insects, disease, or otherwise; to secure such reproduction where necessary and advisable by the planting of seedlings, direct seeding, and aiding natural reproduction; and, generally, to do all things necessary to assure the continuous growth and proper management of commercially utilizable forest.

Climate

For all general purposes the South Olympic Tree Farm area may be divided into two weather zones. The eastern half is the dry zone, receiving an annual average precipitation of 62 inches. The western half is the wet zone, with an annual average precipitation of 116 inches.

The rainy season usually extends from mid-October to the early part of March. Snow fall forms but a comparatively small portion of the annual precipitation and is includ-

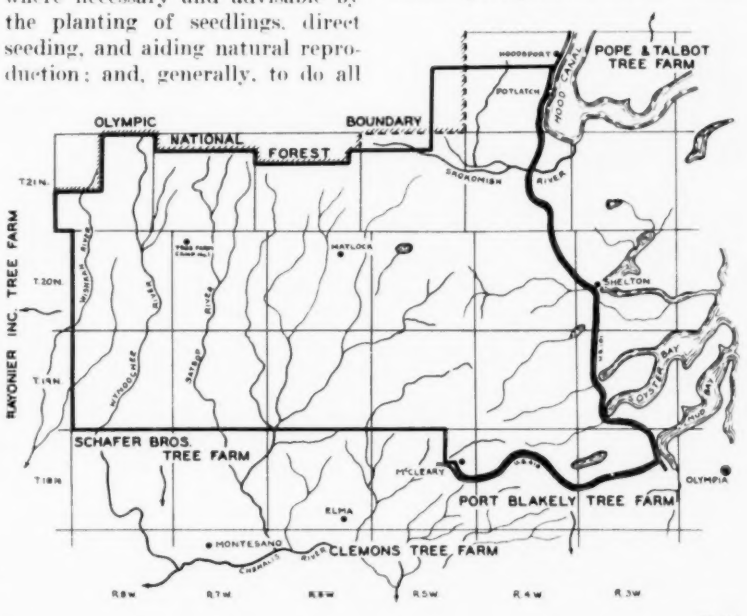

Fig. 1.—Location of the South Olympic Tree Farm, Washington, in relation to neighboring tree farms and the Olympic National Forest.

ed as a water equivalent in the total volume. There is a comparatively small amount of mid-summer precipitation, July and August having the least. This condition has an important bearing on the inflammability of forest materials and the protection problem.

During the average year, the number of days with maximum temperatures of 80° or higher varies from 30 to 43. The number of days during the growing season (between killing frosts) is slightly in excess of 200 and may be as many as 230. The number of days with relative humidity of 35 percent or less varies from 26 to 36.

Since the fuel moisture indicator sticks and weighing scales came into use more than a decade ago, records and experience have made them an integral part of fire prevention and control measures. The number of days annually with fuel moisture readings of 18 percent or less varies from 115 to 125. Under normal fire weather conditions a fire may be prevented and more easily controlled in green timber when the stick moisture content shows a reading of 18 percent or higher.

Personnel

The organization is headed by a managing forester and an assistant managing forester, both with professional education in forestry. Their work is supervised by a board of three trained foresters from the staffs of the member companies.

The office of the managing forester is located in Shelton, Wash. At the field headquarters, which functions under the direction of the assistant managing forester, there is maintained a year-round construction crew who serve as a fire suppression crew when needed. These men also serve as tree planting crew foremen, and operate the forest tree seed extracting plant seasonally. During the more hazardous summer months, an enlarged suppression crew of high school and college students, seeking practical experience in forestry, is employed.

During the late fall, winter, and early spring months, from 40 to 60 men and boys, local farmers are profitably employed planting trees for a period of 3 or 4 months. Regular planting crews are sometimes augmented by college and high school students during vacation periods and weekends.

The Program

In July 1943 the managing forester was charged by the board of directors with setting up a 10-year development and protection plan for the tree farm area, including a program that would bring it to a state of maximum protection against fire, within the then acceptable allowable acreage burn loss of one-quarter of one percent annually. The forester was also charged with the following assignments.

1. Make a reconnaissance of all member lands, and prepare a map of areas proposed for artificial reforestation.

2. Establish a forestry camp at a strategic location on the area for the housing of the fire suppression, construction, and tree planting crews, with storage facilities for fire fighting and construction equipment.

3. Institute a program of services to the member landowners. These services fall into two classifications, general and specific. The general services consist of progressive forestry developments which affect the welfare of the individual member's lands, such as increased fire protection, policing against trespass, management advice, and periodical reports. These general services are covered by an assessment cost per acre annually. The specific services include jobs which an owner may require from time to time, over and above the general services on his particular lands. Such specific services include harvesting and processing forest tree seed, tree planting and direct seeding, rodent and animal predator control, timber marking, technical planning, inspection, marketing reports and supervision, and other activities which are individual in nature. Such specific services are carried out at actual cost to the members.

4. Inaugurate a program of experiments and research to cover those phases of technical and practical development most applicable to the tree farm area.

5. Initiate a program of public relations directed toward those who inhabit or use the area for business or recreation.

FIG. 2.—Some of the buildings at the forestry camp, where are maintained operating crews and their machinery and equipment, and the tree seed extractory.

Fire History

From time immemorial, but more

especially since the beginning of active settlement in western Washington about 1850, forest fires have occurred. The result has been the destruction of billions of feet of standing timber, an incalculable loss of other property, and millions of acres of forest land rendered unproductive for variable periods. Historical records contain frequent reference to the occurrence and destructiveness of forest fires on the Olympic Peninsula, but no complete or accurate figures are available prior to the past quarter-century.

What was possibly the most damaging and extensive fire to occur within the present tree farm area took place on September 11, 1902, over an area west from Matlock and across the Satsop, Wynooche, and Wishkah Rivers to the Humptulips River. Early settlers estimated that the "dark day" fire burned over nearly 200,000 acres of old growth stands.

Logging companies were forced to extend their operations prematurely into the burned area to recover salvable material. During the forty years after the fire, nearly 90 percent of the area had restocked satisfactorily from the remaining seed sources.

During the past ten years, there have been only 14 fires on the tree farm member lands with a total area of 64 acres. The total estimated damage to the 64 acres was $2,000.

Protection Setup

In 1943, the major protection forces in the area were the State Division of Forestry, the Washington Forest Fire Association, and the U. S. Forest Service which was concerned with the protection of the Olympic National Forest to the north and contiguous to the tree farm area. The Simpson Logging Company maintained an auxiliary protection organization covering its logging operations and second-growth stands of timber.

Now the first two agencies operate largely in areas of mixed state and private ownerships; to avoid overlapping and, at the same time, to intensify their coverage their services are pooled. The Forest Service also cooperates in the general protection scheme contiguous to our common boundary.

There are six lookout towers within the boundaries of the South Olympic Tree Farm. One of these lookouts is operated by the Forest Service, three are operated by the State Division of Forestry, and two are operated by the state, jointly, with the South Olympic Tree Farms, each of which will overlook an average of 60,000 acres.

Fire fighting costs are borne by the State Division of Forestry, except that our tree farm crews are paid out of our own funds, voluntarily, when assisting farmers or cooperators in controlling fires on their lands.

At the forestry camp are three telephone circuits. One line connects with the State Division of Forestry system and lookout towers over the west portion of the tree farm. The second system is the Simpson Logging Company railroad dispatcher's line, connecting with Shelton and Simpson's logging camp and operations; this line also gives a connection with the U. S. Forest Service protection organization and the eastern part of the tree farm. The third system is a toll line connecting with the Pacific Telephone and Telegraph Company system.

Our FM radio system is on the same frequency as that of the Simpson Logging Company. We have a base station at the tree farm camp with four mobile units used on patrol and work detail trucks.

During 1949, the use of radio possibly paid for the entire cost of this equipment, as action on a series of lightning fires brought in men and equipment from nearby logging operations in less than an hour, whereas by other means of communication they would have been considerably delayed.

At the forestry camp there are four tank trucks, a D-6 Cat with dozer blade, 6,000 feet of 1½-inch hose, and 1,000 feet of 1-inch hose, together with hand tools, pack-pumps, and equipment for 50 men. During the summer months, a protection crew of at least 10 men is trained and periodically drilled in fire fighting methods and use of equipment.

On the whole, the tree farm area did not have a serious snag problem. However, we have carried on a snag falling program during the 10-year period, confining these operations to tree planting areas and along fire protection roads. The felling of snags along the roads and back a distance of 400 feet reduces the fire hazard. Moreover, tall snags adjacent to frequently travelled roads are a source of danger to persons and equipment. Two-man crews using power saws have felled snags from one to six feet in diameter on the stump, and up to 125 feet high. Salvable material from the snags has been used in bridge and culvert construction and for fuel at the forestry camp.

Seventy water holes for fire protection have been developed at road crossings over streams that have a year-round flow and at springs, small streams, and in swamps. Beaver flowages have been protected against trappers and a network of natural water-holes is available in some very remote spots. The slight damage to the hardwood trees is far outweighed by the year-round water supply.

To supplement the existing public and private roads over the area, we have constructed 160 miles of roads as access for fire protection, tree planting, and general administration purposes. Road maintenance in this area and climate is practically a year-round job. It requires keeping the heavy bracken fern and red alder growth down for six months of the year, and fighting mud and water the other six months.

During the period July 15-October 15, certain areas of high fire hazard are closed to the public. Only residents or persons on official business may enter these designated and posted areas. At the entrances from public roads to our protection road systems are placed the Wisconsin-type railroad iron gates with protected locking devices.

Within the closed areas, however, are certain streams and lakes with corridors for fishermen and

recreationists with camp grounds provided. As small and big game hunting seasons open before October 15 we have managed each year to open part, or all, of our closed areas to hunters under certain easily applied and accepted restrictions, fire weather conditions being the prevailing factor. As will be explained later, sportsmen and forest users have been our greatest and best cooperators in fire prevention.

Tree Planting

In the Pacific Northwest and, in particular, on the South Olympic Tree Farm area, the tree planting season is longer than in most sections of the country because of more favorable climatic conditions. Intermittent rains and little soil freezing allow a planting season extending from early November into April, in normal years, according to elevation of planting sites.

Need for an adequate tree-planting program, foreseen by farsighted wood-using industries in this region more than a decade and a half ago, led to the establishment of the Forest Industries Tree Nursery at Nisqually, Wash., midway between Olympia and Tacoma, where more than 10 million seedlings are produced annually.

During 1943, a reconnaissance of lands in the South Olympic Tree Farm was made to determine reforestation needs and the estimated cost to members. Some 17,000 acres were found to need some degree of artificial regeneration at the time of examination.

Planting of one-year Douglas-fir seedlings has been discontinued in favor of hardier two-year Douglas-fir seedlings from seed of known origin. The planting of western hemlock, western redcedar, Sitka spruce, and other native conifers has not been necessary, as natural stocking of these species has been sufficient for the balanced forest stand.

Ten to twelve-man crews, headed by a foreman, plant in rows 8 feet apart and about 6 feet apart in the rows. An average of 700 trees is planted per acre and one planter will put in about 800 trees per day.

Plantations established during the past ten years show survival of well over 70 percent.

The South Olympic Tree Farm organization plants at actual cost to its members.

TABLE 1.—NUMBER OF ACRES AND TREES PLANTED, NOVEMBER 1943 THROUGH MARCH 1954

Company	Acres	Trees
Simpson Logging Company	11,466	7,409,600
Weyerhaeuser Timber Company	5,776	3,508,200
Milwaukee Land Company	353	243,600
Miscellaneous (other lands)	550	435,000
	18,145	11,596,400

TABLE 2.—THE INCREASE IN PLANTING COSTS, 1943-1953

	Cost per acre 1943-1944	Cost per acre 1952-1953
Preplanting	$ .08	$ .20
Stock	1.61	2.95
Planting Labor	7.99	12.68
Supervision	.52	1.12
Transportation of Stock	.10	.23
Transportation of Men	.85	1.55
Other: taxes, etc.	.68	2.40
	$11.83	$21.13

Experiments and Research

Experiments and studies have been carried on in tree planting, direct seeding, rodent and animal damage and controls, insect and disease surveys, thinnings of second growth stands, fire fighting techniques and new equipment, cone harvesting and seed extraction and, last but not least, human relations with the public and employees.

In 1944 a start was made to secure tree seed of local known origin, by selecting Douglas-fir trees in stands 30 to 50 years old. Such "superior" trees, healthy and vigorous, have small limbs and grow according to the site index.

Since 1949, all seed harvested by the South Olympic Tree Farm has been certified by the Forest Industries Association as to locality of origin, year, species, elevation, age class, and site and processing date.

A seed extractory was built at the tree farm camp in 1949. It has electrically heated kilns and powered machinery. The output for the five years of operation has been as follows.

Year	Bushels of Cones
1949	5,344
1950	4,481
1951	1,434
1952	786
1953	300
Total	12,345

The cones were processed for cooperating members of the Forest Industry Nursery at Nisqually, Wash. The species processed are Douglas-fir, Sitka spruce, western hemlock, western redcedar, and white fir. Cleaned seed recovery from a bushel of cones varies from ¼ to 1 pound, according to species. The decline in number of bushels processed, 1951-53, was due to light cone crops.

Bear Damage and Control

During the summer of 1945, a road crew reported unusual damage to young Douglas-firs on an area between the Wynooche and Wishkah Rivers. It was unlike the damage done by deer or elk when rubbing the velvet off their antlers. The bark was torn from the lower parts of the trunk, sometimes completely girdled, with evidence of claw and teeth marks, indicating the native black bear. Biologists confirmed that the damage was definitely that of bear, which is a game animal in Washington and protected during closed seasons.

The following summer, the same crew, working in the same area, observed that the trees girdled the previous year were dead, and that other Douglas-firs in the same general area had been girdled during the past spring months. Similar damage was found on other areas.

During the summers of 1947 and 1948, stands of 20- to 30-year-old Douglas-fir in the upper Wynooche and Satsop Rivers were becoming pockmarked and streaked with brown-needled trees. The direction of the damage was to the east and south. In the spring of 1949 and 1950, new damage continued, reaching what might be called epidemic proportions.

Bear damage was reported in various other places in western Washington. However, the Olympic Peninsula seemed to be suffering the greatest injury.

Early in 1951, the Puget Sound Section of the Society of American Foresters instituted action to control bear damage to young timber by appointing a Bear Facts Committee. Headed by William Larson as chairman, the committee gathered data on bear damage, and presented its case to the State Game Commission, which took the following favorable action.

1. Bears were declared predators in the five counties of the Olympic Peninsula outside the national parks and forests.

2. Where tree damage was being inflicted by bear, control measures would be under special permit.

3. A study would be undertaken by government biologists in cooperation with the Society committee to determine the reasons for this excessive damage, and, if possible what measures would best solve the problem.

In 1951, the author succeeded William Larson as chairman of the Society's Bear Facts Committee, since the South Olympic Tree Farm was in the heart of the damage area. That spring, a 30,000-acre experimental control area was set up, and forestry students of the University of Washington recorded the bear damage to Douglas-fir stands.

Ten sections, or over 6,400 acres, were examined intensively for bear damage. We found that the stocking averaged 35 conifers per acre over 6 inches d.b.h., of which 20 were Douglas-fir. The dead or damaged Douglas-fir averaged 51 percent; other conifers less than one percent.

Fig. 3.—Managing Forester Oscar Levin inspects typical damage to 30-year old, second growth, Douglas fir caused by black bear. During the past five years the South Olympic Tree Farm lost one hundred trees from damage by bear to one by fire.

Damage was particularly severe in open stands of 20- to 30-year age classes, which were coming into the seed bearing age. The killing of this age-group was eliminating a seed source that could complete the restocking of the area and was thus retarding the rotation period.

One fully stocked section of Douglas-fir second growth showed extensive damage to trees from 10 inches to 18 inches d.b.h. There was little damage at the base, but above the rough bark and heavy limbs severe damage was found at heights of 8 to 30 feet above the ground. The bears preferred to work on the thinner bark.

A control program of hunting and trapping under the supervision of the State Game Department was undertaken in 1951. During the past two years, more than 300 animals have been taken from eight townships where biologists estimate that the bear population averaged close to 4 bear per 640 acres. Recent field checks on the control areas indicate that the removal of the bear from the heavily damaged areas during the past two years has lessened the damage more than fifty percent.

The bear's love of sweets is well known. Over the years, woodsmen from Alaska to California have mentioned in their cruising reports that bear have been observed girdling trees during the spring months, but not extensive enough to cause great damage. It was common knowledge that when the bear removes the bark of certain trees and scratches the delicate cambium layer, a sweet juice oozes out. As the damage spread, the bears changed their appetites. Although preferring Douglas-fir, they damaged hemlock, cedar, spruce, and red alder.

Few bear are killed during the open hunting season as hunters prefer deer and elk. The increase of bear population over the years through protection undoubtedly caused a food shortage during the spring season. Studies conducted during the control program revealed that 75 percent of the bear had cambium strippings in their stomachs during the months of May, June, and July. Moreover, analysis of stomach contents showed that one out of twenty bears had killed fawn during the early season.

Based on records during the past five years our tree farm lands have lost 100 trees to bear for one by fire.

Rabbit Damage

Because of extensive damage to newly established plantations during the past three years, primarily to Douglas-fir seedlings, the Puget Sound Section of the Society of American Foresters has again taken the lead by setting up a Rabbit Control Committee, of which the author is chairman also. Working on the committee are foresters from industry and public agencies whose lands have suffered excessive damage.

A technical advisory group is carrying on studies with rabbits in pens and in the field to determine seasonal food habits in western Washington, and trying out vari-

TABLE 3.—ACCOMPLISHMENTS AND COSTS

	Number of unit	Average cost per unit	Total
Snag Falling	1,527	$ 4.17	$ 6,375
Camp Construction	14 bldgs.	.....	14,351
Water Holes	75	22.26	1,669
Road Maintenance	100 mile av./yr.	33.47	33,473
Fire Road Construction	160 miles	285.31	45,649
Bridges	8	393.52	3,148
Fire Road Gates	30	135.50	4,078
Pre-suppression	10 years	6,449.93	64,499
Sign Posting	10 years	273.25	2,732
Experiments—Research	10 years	677.60	6,775
Fire Fighting	14 fires	.....	196
Administrative	10 years	6,250.25	62,502
Total			$245,447

ous repellents and baits. Both the State Game Department and the U. S. Fish and Wildlife Service biologists are cooperating in this program.

What's the Cost?

The cost of running the South Olympic Tree Farm during the 10-year period from July 1, 1943, to June 30, 1953, is tabulated in Table 3.

Public Relations

Public relations has been well defined as "the process of finding out, and making known, the factors in an enterprise which are of public interest." The public relations of forestry may, therefore, be said to be the finding out and making known the facts and principles of forestry which are of interest and value to the public.

All public relations work must necessarily have an objective. In forestry, it is to awaken public interest and quicken public understanding of forestry with the motive that there may be built up and retained a support for the cause of forest conservation. The great need is to make and keep forestry popular with the public.

Ninety percent of the entire land area within the boundaries of the South Olympic Tree Farm is forest. Hence, our neighbors, knowingly or not, are in this tree-growing business with us.

Starting in 1943, we of the South Olympic Tree Farm stepped into an area where considerable ground work had been done in forest protection by the Simpson Logging Company and the Weyerhaeuser Timber Company, on their own initiative and in cooperation with the recently inaugurated "Keep Green" and "Tree Farm" programs. Also, the state and federal Forest Services had become partners with the forest industries and civic groups in the rapidly growing forest protection consciousness of the people.

Keep Green

The first county "Keep Green" unit in the United States was formed in Mason County, Washington, in 1944. This movement spread to neighboring counties, then throughout the state and nation.

Of the population of some 15,000 urban and rural residents within the confines of our tree farm, it is safe to wager that the proverbial 99-plus percent is aware that there exist Keep Green organizations in Mason, Grays Harbor, and Thurston Counties.

The county committees are run, not by foresters or persons engaged in the forest products industries, but by officers and committeemen and women for the most part in nonrelated industries wholly or partially dependent on the forest community for a livelihood.

The county committees function the year around in their process of education through advertising, publicity stories, public talks, school and youth group talks, illustrated talks and movies, radio talks, signs and posters, exhibits, and letters. There is no seasonal let-up; every month is a forestry month.

Mason County Forest Festival

The Mason County Forest Festival had its first showing in April 1945. Our country was still engaged in World War II.

Mason County has 400,000 acres of junior forests and old growth timber. The annual fire loss, although on a gradual decline during the past decade, was still too high, averaging nearly 200 acres a year, with only 5 percent of some 50 fires a year caused by lightning.

A group of forest-community minded citizens developed the first forest festival, and now function as a Festival Association jointly with the County Keep Green Committee and the Shelton Chamber of Commerce. Shelton's 5,000 inhabitants are joined by some 10,000 from the rest of the county in staging the three-day observance.

Briefly this is what goes on.

On Thursday night a pageant "The Magic Tree" is presented by a cast of 500 school children. The script for the pageants is written by James Stevens. As the Shelton High School stadium has a seating capacity of 5,000, it is necessary to put on a repeat performance for another audience of equal size the following night.

On Saturday morning a mile-long Paul Bunyan Parade of prize-competing floats stressing the theme "Keep Washington Green" is viewed by over 20,000 people from all parts of the Pacific Northwest. On Saturday afternoon some 15,000 persons watch loggers and woodsmen demonstrate their skills. The contestants perform in the following events: log truck and trailer driving contest, tree planting demonstration, Christmas tree tying and bundling contest, tree climbing contest, log chopping contest, cable splicing contest, log bucking (hand) contest, tree topping demonstration, tree falling contest, power saw demonstrations (falling and bucking).

Sportsmen and Forest Users

During the big and small game hunting season our 176,000 acres of tree farm lands are practically a free range to sportsmen. Only in a few instances, due to weather

conditions, have entrance restrictions been imposed. For the convenience of deer, elk, and bird hunters, we have in the past opened our closed areas in advance of October 15, to coincide with the deer and bird seasons early in October.

In the summer and fall of 1952 was possibly one of the longest drought periods western Washington had experienced in thirty years. The regular deer hunting season, scheduled to open on October 5, could not be opened due to the explosive condition of the forest areas. By agreement, the State Game Department, the Forest Service, and the forest industry together with a vast majorty of the sportsmen's organizations postponed the opening for one week.

No rain fell during the week; however, the nights were getting cooler and morning fogs coming in from the Pacific partially relieved the situation. A conference among the protection organizations within our tree farm area granted hunting until noon of each day, with no smoking or camp fires. The resulting opening of the area made a volunteer forest warden out of every hunter. Not a fire resulted. The rains came on October 19.

In the fall when we open our gates and roads for the hunters' use, we remove the fire enclosure signs and replace them with a "Welcome Sportsmen" sign, telling them that this area has been opened for their use and pleasure, still cautioning against carelessness with fire and to travel at moderate speeds over the one-lane protection roads.

We allow fishing on all streams until July 15, after which date a few restricted high hazard areas are placed under fire closures until October 15, except that we have provided corridors along the best streams with conveniently located camp sites.

Trees and animals live together, so can sportsmen and foresters.

Berry pickers and scores of people engaged in the harvesting of minor forest products, such as huckleberry brush, sword fern, salal, and moss for the greenery trade, are seasonally in the area. The control of persons harvesting such products was solved by issuing permits at nominal charge per each forty-acre tract. As there are over 500 people on full and part-time employment seasonally in our area, this group provides us with another volunteer detection and suppression force.

Our member companies have been allowing the cutting of a limited number of Christmas trees. Reliable operators, under strict regulations and supervision of foresters, are doing an ultimate thinning job in young Douglas-fir stands. Over one million Christmas trees a year are produced from all lands in our area for shipment to eastern markets. This seasonal employment totals about 400 persons.

Our Tree Farm Neighbors

Surrounding the South Olympic Tree Farm are neighbor industrial tree farms. To the west, across the Wishkah River, we are joined by the large acreage of the Rayonier, Inc. Tree Farm. To the south is the Schafer Tree Farm, and across the Chehalis River is Weyerhaeuser's Clemons Tree Farm of some 200,000 acres. The Port Blakely Tree Farm joins our boundary on the southeast.

Requests from Mason County farm forest landowners prompted the Amerien Forest Products Industries and the Industrial Forestry Association, as regional sponsoring organizations, to choose Mason County out of some 3,000 counties in the United States as the testing ground for the promotion of small tree farms and farmer-owned tree farms. A county committee was set up with representatives from private and public forestry organizations working up management plans to a level justifying designation as a tree farm. As a result of the cooperative efforts of the foresters serving on the County Tree Farm Certification Committee, 10 farmers with 2,309 acres committed to management are the forerunners of over 30 more applications being processed.

Preservative Treatment For Paperboard Seed Traps

At Nacogdoches, Texas, a year's use of the kraft paperboard seed traps described by Easley and Chaiken (Jour. Forestry 49:652-653, 1951) showed that they are not only cheaper than standard wire traps ($2.55 installed, as against $4.20), but easier to find for periodic reexamination, easier to empty, and less likely to be stolen. Their lack of durability, however, reduced their price advantage over the wire traps for use beyond one season, and suggested the desirability of preservative treatments.

Twelve months' exposure of replicated brush-treated and untreated paperboard traps showed that any one of three treatments should extend the usefulness of such traps at least through a second season. The brush treatments were: (1) 5 percent pentachlorophenol in linseed oil; (2) a saturated solution of paraffin in naphtha; and (3) clear shellac. The first seemed best because it prevented the formation of mold on the paperboard.

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The Role of Surveys in Forest-Insect Control

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FOREST-INSECT SURVEYS are not a new development in the United States. They have been conducted annually, especially in the important pine-producing areas of the West, for nearly 50 years. Their primary purposes have been to determine where and when control measures were needed, to determine trends of the insect populations, and to measure the amount of current and recent loss of timber.

With passage of the Forest Pest Control Act by Congress in 1947, the way was opened for more active cooperation by the states, private companies, individuals, and the federal government in the conduct of survey and control work against forest insects and diseases. Since 1949, Congress has also provided larger amounts of money to finance the federal share of the survey work, with the result that most important forest areas are now receiving some attention from forest entomologists each year. New survey-station headquarters were opened in Ogden, Utah, in 1949 and at Albuquerque, New Mexico, in 1952. In 1952 a man was assigned to the Portland, Oregon, station to work in Alaska, and additional personnel were assigned to the southern states. The present survey organization serves as a central clearing house for reviewing and coordinating reports of insect infestations as reported by a large number of private individuals and representatives of various state and federal agencies. It is not large enough, however, to fully meet its obligation in making field examinations or intensive surveys of many of the infestations that are reported, nor can it handle adequately the increasing demands for technical assistance and supervision needed on control projects. Lack of trained and experienced personnel and, to some extent, limitation of funds have prevented more rapid expansion of the federal survey organization. Fortunately, there has been a tremendous increase in the amount of work being done by private and state organizations within the last 5 years. This excellent cooperation between agencies and individuals who are concerned with forest protection has done much to stimulate public interest in the program.

Most of our current forest-insect surveys are quantitative in character and limited to insects of known economic importance. We do, however, recognize that new problems may develop from time to time, often as a result of changed forest conditions following logging, fires, or extensive blowdowns of green timber. Our purpose is to detect increase in the abundance of important pests before serious economic losses have occurred, to determine where and when chemical control is needed, and to measure the losses caused by the insects.

Types of Forest-Insect Surveys

We conduct five different types of surveys. They are called detection, reconnaissance, appraisal, area-hazard, and damage surveys. The first three are by far the most common and form the basis for most control operations.

Detection surveys.—These, as the name implies, consist of observations and reports of insect infestations. Their purpose is to reveal the presence of harmful or potentially harmful infestations of forest insects prior to their development to outbreak proportions. They may be made by anyone, at any time, and at any place. They are seldom planned or conducted as separate jobs. Instead, such observations are usually made incidentally to other activities. For this reason, we should be able to depend upon foresters, lumbermen, and other people who spend time in the woods to report many insect infestations. In practice, we find that very few woods workers notice insect damage unless they have been given special training. Even technically trained foresters often fail to see insect damage before it becomes severe. One of our objectives, therefore, is to give such training to as many people as possible and awaken their interest so that they will see and report any situation that appears to be unusual.

Reconnaissance surveys. — These are conducted to determine the extent of known infestations, the amount of injury being done, the trend of the infestation, and the need for control measures. They are made by trained personnel, who are competent to make decisions as to the seriousness of a situation and to recommend further action.

Appraisal surveys.—This type of survey involves systematic sampling of infestations that are considered to be of such character as to warrant control, or of timber stands after completion of a control program to determine its effectiveness. They are used to determine the number of trees or acres to be treated or the amount of infestation remaining in an area that has been treated. Appraisal surveys often serve as the basis for large expenditures of money. They provide data that are used in planning control projects, including purchase of material, hiring of men, and supplying the necessary supervision. They must be accurate if waste of timber, money, and manpower is to be avoided.

Area-hazard surveys. — These surveys are made to determine the relative susceptibility of forested areas to insect attack. They are based upon knowledge of the conditions that render certain timber stands more susceptible to insect attack than others. They are very important from the standpoint of the forest manager, because they serve as a guide in making decisions as to which stands

[1] U. S. Dept. Agric., Agricultural Research Administration.

should be harvested first. This type of survey has been applied most extensively in the ponderosa pine areas of northeastern California and eastern Oregon.

Damage surveys.—Surveys of this kind are made periodically in certain areas to determine losses due to insect activity and to accumulate information on infestation trends. They are important in connection with timber-resource studies and in formulating long-term timber management plans. They have been applied only to a limited extent thus far, chiefly in California and Oregon.

All these types of surveys must be based upon accurate observations and measurements. Most of them involve the systematic sampling of areas on the ground. Permanent sample plots, ranging in size from 1/10 acre up to 320 acres, are used for certain purposes where continuous records on specific areas are needed. Appraisal surveys usually involve large numbers of temporary plots that cover up to about 5 percent of the infested area. Plots of various shapes and sizes are used for this purpose. Strip samples, usually one chain (66 feet) wide, are spaced at intervals of ¼ or ½ mile. Circular plots of 1/5 to ½ acre spaced at intervals along compass lines are also commonly used. These are expensive and time-consuming procedures, especially in rough, inaccessible country, even when the size and number of plots are reduced to a minimum.

Development of Aerial Surveys

Emphasis is now being placed upon the development of methods of making aerial surveys by direct observation and by aerial photography. Extensive use of these methods has been made in locating and appraising areas of severe damage caused by the spruce budworm, the fir tussock moth, the Douglas-fir beetle, the Black Hills beetle, the western pine beetle, and several other important forest insects. The largest project has been the surveying of spruce budworm infested areas in Oregon and Washington, which has consisted of 40 to 50 million acres of forest land each year since 1949. About 200 individuals have cooperated by making ground examinations, which are correlated with conditions as observed from the air. Information thus obtained is used in deciding which areas justify spraying the following season. Since the control program is also a cooperative undertaking, with large sums of money involved in control costs and timber values, all agencies concerned are very critical of all survey data presented for consideration.

Aerial surveys are many times faster and much cheaper than ground surveys. They can be used successfully for most defoliators and for certain bark beetles and other insects that cause a change in color of the foliage on infested trees. They are especially valuable in outlining areas and relative degrees of infestation, but usually need to be supplemented with ground samples to obtain more specific information on number and volume of trees killed or injured by the insects. For certain species—as, for example, the Engelmann spruce beetle—aerial surveys are not of much assistance in locating current infestations. This is because infested spruce trees drop their needles before there has been much change in color. In other instances, the foliage may not fade until after the insects have left the trees.

Benefits of Surveys

What can surveys be expected to accomplish toward reducing the losses caused by forest insects and the need for control measures? Certainly there will be less excuse for allowing extensive outbreaks to develop before the land-managing agencies or owners become aware of their presence, as has too often been true in the past. Early detection will permit the prompt planning and application of direct control for those pests for which effective and practical control measures are known. The prompt application of control on limited areas may prevent widespread outbreaks and extensive loss of timber. Perhaps it will be necessary to treat many localized infestations before one will be included that would have developed to serious proportions if left untreated. Even so, the cost in money, manpower, and timber will be only a small fraction of that in a large outbreak.

On the other hand, certain insects build up rapidly over large areas and with little evidence of localized infestations. They may require extensive and expensive control operations even though detected and reported promptly. Control costs, and especially the loss of timber, should be less when prompt action is taken to check such outbreaks, but it is doubtful that they can be prevented by direct control methods.

It is therefore unlikely that a marked reduction in our need for insect-control funds will occur, but a better balance between money spent and values protected can be expected. More complete information about insect infestations will mean a larger number of requests for money to do control work, but we will be buying more protection with this money.

An important benefit to be derived from a more adequate survey program is the greater utilization of timber killed by insects. Owners and land managers will receive earlier warning as to where timber is being killed or is likely to be killed by insects. This information will permit them to plan their logging operations so as to remove the timber before too much of its value is lost.

Surveys should be considered as tools that enable entomologists to determine where and when forest-insect outbreaks are going to occur, where and when direct control measures are needed, how effective these measures are when applied, and where utilization cuttings are needed to prevent excessive losses. Neither surveys nor direct control measures, in themselves, help to make our forests any more resistant to insect attack, nor do they have any permanent effect in helping to prevent future outbreaks. It is therefore important that they be considered as of only supplementary value and that more em-

phasis in our forest-insect program should be placed upon research that will develop information regarding the basic reasons for changes in insect populations, more complete knowledge of the biologies and habits of the various insect pests and their natural enemies, and silvicultural methods that will produce forests that are more resistant to insect attack.

It is obvious that many years of research will be required before much of the needed information can be obtained. There are many large forest areas that are too inaccessible to be developed and placed under intensive forest management in the foreseeable future. The growing and managing of forests is a long-term undertaking in which major changes can be made only gradually and only under favorable economic conditions. Furthermore, intensive cultural practices may not prove to be a complete answer to forest-insect problems, if experience with agricultural crops can be used as a measure of probable success. It therefore seems certain that the need for control will continue indefinitely and that an adequate survey program must be developed as a means of keeping control costs at a reasonable level.

Labelling and Storing Increment Cores

Labelling increment cores for future identification and storing them to prevent breakage generally presents a problem. For large collections, the most commonly practiced method is to store the cores in the grooves of corrugated paper. Such paper is somewhat bulky, and care must be taken to prevent mixing the cores.

The labelling and storing of increment cores can be facilitated by placing each core, immediately after extraction, in a paper soda straw and pinching the ends closed. The necessary data can then be written on the outside of the straw with either an ordinary pencil or a wax pencil. A cardboard mailing tube or small flat box serves as a convenient carrying case. Fresh cores should be dried to prevent discoloration before storage for long periods of time. This can be done, after returning from the field, by opening one end of the straws and spreading them out in a dry place until the cores are dry.

Since both straws and increment borers vary in diameter, several straw sizes may have to be tried. The large-sized straw commonly served with malted milk is entirely satisfactory.

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Eradication and Thinning Tests for Nectria and Strumella Canker Control in Maryland

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STANDS OF MIXED OAK in the Northern Allegheny Plateau are often severely cankered by Nectria and Strumella (Fig. 1). Such is the case on the Swallow Falls State Forest, near Oakland, Maryland. Several plots to study the effects of canker eradication and of thinning heavily cankered stands were established between 1933 and 1935.[3] The main objective was to determine if the losses from Nectria and Strumella might be reduced through such practices.

Severe Nectria infection, caused by *Nectria* spp., results in malformation of trees, and subsequent cull where the cankers are large. Occasional cankers kill or make trees susceptible to wind or ice breakage. Small cankers produce only minor defects in the centers of logs. Strumella, although usually less abundant than Nectria in young stands, is a more serious disease, since many infected trees eventually die or are broken over at the canker. Strumella canker is caused by *Strumella coryneoidea*.

As a general rule, both Strumella and Nectria cankers are particularly abundant in areas where ice storms are common. Most such cankers enter the main stem of a tree at the axil of a branch.[4] Heavy loads of ice on small branches sometimes cause cracking in the axils of the branches, through which spores of the fungus enter and cause infection.

FIG. 1.—*A*, Nectria cankers on a black oak. *B*, Scarlet oak with a Strumella canker.

Results of Canker Eradication

In 1933, an attempt was made to eradicate all of the Nectria and Strumella cankers on one area of approximately 11 acres, and another area of approximately 186 acres, in order to compare subsequent cankering on such areas with that on areas in which no cutting had been done. At the time of eradication, the stands were between 30 and 40 years old, with most of the trees in the 2- to 5-inch diameter classes. On the eradicated areas all living trees with Nectria and Strumella cankers were eliminated by cutting or girdling.

At the time the plots were established, part of each area had all cankered trees felled, another part had all cankered trees girdled, while on the remaining area the cankered trees were tallied and left standing. It soon became apparent, however, that differences in incidence of new cankers on the cut and girdled areas were not great enough to warrant a continuation of this breakdown. Consequently, all treatments after the initial one were made so as to conserve time and labor. Small trees that could be felled with one or two strokes of an axe were cut and larger trees were girdled. Reeradications and observations were conducted during 1940, 1944, 1947, and 1951.

Since the treated areas were bounded on all sides by untreated stands, it appeared that the effect of eradication could not be measured fairly by considering the whole treated area. Therefore, a 2.7-acre plot was established in 1940 within the 11-acre treated area, and a 22-acre plot within the 186-acre treated area. These plots had, in effect, isolation strips around them, of the additional 9 acres in one case and 164 acres in the other. The effect of eradication was determined by comparing canker development on the small treated areas just referred to as plots, with that on the control areas. Final results showed that the incidence of new cankers in the plots did not differ materially from that in the areas as a whole.

[1]We gratefully acknowledge the interest and ready cooperation of the Maryland State Forest Service, which greatly facilitated this experimental work.

[2]Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, in cooperation with the Southeastern Forest Experiment Station.

[3]The Maple Glade and Briar Ridge eradication plots were established in 1933 under the supervision of R. M. Lindgren, using local C.W.A. labor. The Kiness and C.C.C. Camp thinning plots were established in 1935 by R. C. Lorenz, formerly of the Division of Forest Pathology. C.C.C. labor was used in the 1940 re-eradication.

[4]Grant, T. J., and P. Spaulding. Avenues of entrance for canker forming Nectrias of New England hardwoods. Phytopath. 29: 351-358. 1939.

TABLE 1.—CANKER REGENERATION ON ERADICATED AREAS[1]

Areas and dates of examination and eradication	Nectria			Strumella			All cankers		
	Whole area	Plot	Check	Whole area	Plot	Check	Whole area	Plot	Check
	Number								
Maple Glade:									
1933	927	—	318	597	—	142	1,524	—	460
1940	489	107	46	45	11	0	534	118	46
1944	18	0	15	58	11	6	76	11	21
1947	11	0	4	67	15	12	78	15	16
1951	6	1	2	47	12	13	53	13	15
Total	1,451	108	385	814	49	173	2,265	157	558
Briar Ridge:									
1933	6,045	—	664	3,530	—	257	9,575	—	921
1940	3,126	393	192	1,055	327	45	4,181	720	237
1944	—	157	84	—	239	86	—	396	170
Total	9,171	550	940	4,585	566	388	13,756	1,116	1,328

[1]The Maple Glade whole area, plot, and check area were respectively 11, 2.7, and 2.2 acres.
The Briar Ridge whole area, plot, and check area were respectively 186, 22, and 5.9 acres.

Table 1 shows the increase in number of cankers on the treated and untreated areas at each examination. Apparently quite a few cankered trees were missed in the 1933 eradication, as evidenced by the large number of additional old cankers found in 1940, which was the next examination date. Considering both Nectria and Strumella cankers, the 11-acre treated area in 1940 showed 35 percent as many cankers as were removed seven years earlier, while on the control area there was an increase of only 10 percent in the number of cankers. By 1944, 1947, and 1951 new cankers on both the treated and untreated areas had increased at about the same rate over the original number of cankers, despite re-eradications at each period. For the 18-year period the treated area showed 49 percent as many cankers as the original number, in contrast to a 21 percent increase on the untreated area.

Investigations on the 186-acre Briar Ridge area were discontinued after the 1944 readings because of hurricane damage. In 1940, there were over 44 percent as many cankers as the original number on the eradicated area, and a 26 percent increase over the original number on the check area. Data taken only on the check area and the 22-acre plot in 1944 showed a decrease in the number of new cankers formed. The decrease was not as great as on the smaller Maple Glade plot.

An important point in Table 1 is the very sharp drop in the number of new Nectria cankers on the Maple Glade plot as the age of the stand increased. There were 84 Nectria cankers per acre in the whole area in 1933, but less than 2 new cankers per acre formed in the seven years from 1944 to 1951. For Strumella there were roughly as many new cankers per acre in 1951 as in 1940, and there was very little difference in new cankering between treated and untreated areas.

Thinning as a Measure to Stimulate Healing of Cankers

A great many of the young oak stands on the Swallow Falls State Forest were very dense, many having several thousand saplings per acre. Since Nectria cankers were abundant, it seemed advisable to determine whether thinning would increase the rate of healing of the cankers and possibly decrease the likelihood of new canker formation.

On a 5/8 area known as the Kiness Tract, a badly cankered 13-year-old white oak stand, supporting about 5,000 trees per acre, was heavily thinned so that the trees were about 12 feet apart, releasing the best trees but without regard to cankers. A portion of the same stand was left unthinned. Certain trees on each of these areas, because of their spacing and dominance, were designated as crop trees. Every canker on these designated crop trees was measured and numbered and has been remeasured at intervals. New cankers that developed in the intervals between remeasurements have been recorded and measured. This experiment was repeated in a similar but somewhat older (24 years) and less dense white oak stand supporting about 600 trees per acre. On the latter plot the trees in the thinned part were reduced to a spacing of about 17 feet.

Table 2 shows the effect of thinning on canker healing for the 16 years following treatment. In general, the most active period for new canker formation was under 20 years. Under adverse conditions, cankers continued to form, as evidenced from the 17 percent new Nectria cankers shown for 1951 on the thinned 24-year-old plot. These new cankers had formed at new frost cracks, at old wounds opened as a result of freezing, and on small branches. After the trees passed 20 years of age more of the cankers were healing out than were continuing to enlarge. There was no consistent difference in the relative rates of healing between the trees on thinned and unthinned plots, or between dominant and codominant trees as compared with intermediate and suppressed trees on the unthinned plots. The drop in the number of cankers for each succeeding reading is explained by the fact that during each period trees died from suppression or other reasons. Neither degree of thinning nor age of the stand had much effect on healing rate.

The data on the behavior of the Strumella cankers in these thinned plots are presented in Table 3. The behavior of Strumella was very different from Nectria. A high percentage of new cankers continued to appear on both plots, regardless of tree age. Since thinning had no effect on canker incidence or healing, no division was made in Table 3 regarding this point. Of the 46 cankers measured in 1951, only 24 percent of them were smaller than at

the previous examination. There were also seven new cankers, and nine trees had been killed since 1947. There was a total of 30 Strumella cankers in 1935 on the 2-¾ acres of the two plots. Through 1951 49 new cankers were formed, an increase of 163 percent. Since the study was initiated in 1935, 27 trees have been killed as the result of Strumella cankers, or almost as many trees as were originally cankered.

Discussion

Attempts to eradicate all cankered trees over extensive areas where cankers are abundant are likely to be far from complete. Even in our experimental work, where a diligent search was made for cankers, infected trees were sometimes missed. This was especially true for Strumella, which may be high on the bole and inconspicuous because bark is retained on the surface. Furthermore, apparently little or no control was accomplished, so that attempts to eradicate Nectria and Strumella in infected oak stands cannot be recommended on the basis of this study. Where cankered trees can be utilized or removed in connection with other operations, their removal will often give more growing space to the better trees.

For Nectria, decrease in the rate of new cankering took place regardless of eradication and was due to the growth of the trees beyond the susceptible age of about 20 years. It would appear that eradication measures for the control of Nectria cankers in stands of small pole-size are needless and accomplish little. For Strumella, neither eradication nor advance in tree age affected the development of new cankers, as they continued to form on both the older eradication plot and the young thinning plots. It is not known just how old a stand must be before Strumella cankers fail to form.

Davidson[5] presents evidence

[5]Davidson, R. W. *Urnula craterium* is possibly the perfect stage of *Strumella coryneoidea*. Mycologia 42: 735-742. 1950.

TABLE 2.—EFFECTS OF THINNING AND TREE AGE ON SIZE AND INCIDENCE OF NECTRIA CANKERS

Plot, tree age, and treatment	Cankers	Change in canker size			Increase in number of cankers
		Larger	Same	Smaller	
	Number	*Percent*	*Percent*	*Percent*	*Percent*
Kiness—trees 13 years old in 1935					
Thinned					
1939 compared to 1935[1]	80	51	5	44	45
1944 " " 1939[2]	91	18	4	78	11
1947 " " 1944[3]	59	51	3	46	15
1951 " " 1947[4]	57	21	2	77	7
Unthinned					
Dominant and codominant trees					
1939 compared to 1935	27	33	7	59	4
1944 " " 1939	17	0	6	94	12
1947 " " 1944	12	25	0	75	17
1951 " " 1947	7	14	14	71	0
Intermediate and suppressed trees					
1939 compared to 1935	115	46	7	47	21
1944 " " 1939	81	15	9	77	5
1947 " " 1944	49	29	8	63	8
1951 " " 1947	39	18	3	79	0
CCC Camp—trees 24 years old in 1935					
Thinned					
1939 compared to 1935	241	27	11	61	10
1944 " " 1939	172	5	1	94	1
1947 " " 1944	70	16	3	82	1
1951 " " 1947	52	12	0	88	17
Unthinned					
Dominant and Codominant trees					
1939 compared to 1935	85	36	9	54	5
1944 " " 1939	69	4	0	95	0
1947 " " 1944	34	18	0	82	0
1951 " " 1947	25	16	0	84	4
Intermediate and suppressed trees					
1939 compared to 1935	115	30	9	61	5
1944 " " 1939	86	9	3	87	3
1947 " " 1944	54	18	11	71	0
1951 " " 1947	38	21	5	74	3

[1]Cankers open in 1935, remeasured in 1939.
[2] " " " 1939, " " 1944, including those new since 1935.
[3] " " " 1944, " " 1947, " " " " 1939.
[4] " " " 1947, " " 1951, " " " " 1944.

TABLE 3.—CHANGE IN SIZE AND INCIDENCE OF STRUMELLA CANKERS ON THINNING PLOTS

Plot name and size	Cankers	Change in canker size		New cankers	Trees killed
		Larger	Smaller		
	Number				
Kiness—1¼ acres					
1939 compared to 1935	10	2	0	7	2[1]
1944 " " 1939	15	4	0	7	4
1947 " " 1944	13	4	4	2	4[1]
1951 " " 1947	11	6	2	3	3
CCC Camp—1½ acres					
1939 compared to 1935	17	10	0[2]	4	2
1944 " " 1939	24	8	2[2]	10	4[1]
1947 " " 1944	32	11	7	12	2
1951 " " 1947	35	17	9	4	6[1]
Both Plots Combined					
1939 compared to 1935	27	12	0	11	4
1944 " " 1939	39	12	2	17	8
1947 " " 1944	45	15	11	14	6
1951 " " 1947	46	23	11	7	9

[1]One new canker had already killed tree at time of examination.
[2]One canker closed.
[3]One canker same size.

that *Urnula craterium* is probably the perfect stage of *Strumella coryneoidea*. He found this fungus commonly on fallen cankered trees on the Swallow Falls eradication area. Since spread of Strumella canker may be by Urnula ascospores, rather than by Strumella conidia, cutting infected trees might serve to increase cankering if the trees are left on the ground. In the eradication areas a greater percentage of new cankers developed than on the check areas. This could have been due either to more formation of Urnula inoculum on down trees or to wounds caused by felling.

Although Nectria cankers were common on oaks in western Maryland, oaks generally are among the eastern species least affected by Nectria. On the Swallow Falls area, as the age of the trees increased, there was less cankering and many existing cankers were healing. The ultimate effect of the cankers on the timber by the time it reaches sawlog size will probably not be great, although there will be some malformations, additional cull, and central cores of little value.

Summary

Over a 16-year period, thinning failed to increase the rate of healing of Nectria and Strumella cankers on oak.

Attempts to reduce subsequent cankering by eradication of Nectria- and Strumella-cankered trees four times over an 18-year period proved unnecessary against Nectria and ineffective against Strumella.

The treatment for Nectria proved unnecesary because most trees were beyond the age of abundant infection. Treatment was ineffective against Strumella, possibly because no reduction in fruiting of the fungus resulted from felling the cankered trees.

Silvicultural treatment in cankered oak stands in the Allegheny region should be aimed at the selection of canker-free crop trees and utilization of cankered trees, rather than at control by eradication or thinning.

Growth Versus Allowable Cut

Paul C. Guilkey
Forester, Lake States Forest Experiment Station.[1]

TRADITIONALLY, one critical basis for evaluating the forest situation has been the growth-drain ratio. Nationwide growth-drain comparisons have significance for they show simply where we stand nationally in balancing our timber budget. They are also a useful expression for showing trends in our forestry effort over a period of time. On a single forest tract and for small political units, such as townships, counties, and even states in some instances, it is questionable if the current growth-drain ratio reflects the desirable—from the management approach—harvest of merchantable timber at a given date. Unless some measure other than the growth-drain ratio is used too, misleading conclusions about the timber situation may be indicated.

In the far West the problem is to prolong the harvest of mature and overmature timber until the second growth becomes ready for harvest and able to support the dependent industries that have been established on the backlog of virgin timber. In the East and in the Lake States the problem is to build up the generally understocked stands until they are capable of sustained yield at much higher levels than at present. In neither case does current annual growth indicate how much timber it is desirable to cut currently.

In the Lake States the effect on growth of an improvement cutting removing 10 cords per acre of jack pine from an 80-year-old mixed red pine-jack pine stand is very different from the effect on growth of the same volume obtained by clear cutting a young jack pine stand. Under such conditions growth-drain comparisons alone are not adequate for an analysis of the forest resource conditions. The growth-drain ratio can be characterized as being satisfactory only where growth is at the desired level and the drain comes from the portion of the stand which is mature and ready to cut.

To provide a sounder base for evaluating local situations, the forest survey organizations in the Lake States have been employing a calculated "allowable cut" to measure the yield capacity of the forest.

What Is Allowable Cut?

Allowable cut is defined as the quantity of merchantable timber that may be cut annually during the next ten years while maintaining or building up toward a desirable level of growing stock and effecting a reasonably even distribution of size classes during the rotation selected for each type. Step by step this concept builds up along with the forest inventory a detailed estimate of the immediate timber yield capacity of the forest taking into account the condition of the land and timber and the local objective of forest management. The allowable cut is usually a compromise between the silvicultural needs of the existing stands and the economic aspects such as the need for maintaining dependent industries and communities.

A similar but more long-range concept of allowable cut is followed in the national growth goal approach proposed for the Timber Resource Review project of the Forest Service. The plan provides for setting a national growth goal, fifty years hence. This goal is defined as the annual net yield required to meet future wood requirements plus a margin for export, catastrophic losses, national emergencies, new forms of wood use, and other factors. Such a goal calls for a growing stock of certain size to sustain yields at a given level. In turn, it calls for planning periodic yields (allowable cuts) consistent with reaching the growth goal in a specified period.

How Used in Lake States Forest Survey

Estimating allowable cut, type by type, and stand class by stand class, has been one of the main sampling considerations in the Lake States survey. On each sample plot tallied for volume and sampled for growth, the timber estimator records his judgment of how much per acre should be cut within a ten year period. To help in forming this judgment he is provided:

1. Silvicultural guides.
2. Recommended rotations and cutting cycles.
3. Desirable growing stock levels (expressed in basal area per acre for various types and age classes).
4. Standards for operability.
5. An opportunity to observe timber sales on managed public forests.

The methods used in calculating the allowable cut of a unit must be in accord with the management objectives of a basic plan. In this region all available silvicultural and economic knowledge is brought to bear on the selection of silvicultural methods, rotations, cutting cycles, and products to be grown. Usually uneven-aged silviculture is assumed in forest types composed of tolerant species that will reproduce and grow well under shade. Both the tree selection and the group selection method are used depending upon the species to be favored. All cutting is based upon the size, quality, vigor, and species of the trees in the stand and designed to improve the vigor and growth of the residual stand. First, all trees which are defective, poorly formed, or of undesirable species that can be removed without adversely affecting the site or the residual stand, are listed for removal in an improvement cut.[2]

[1] Maintained by the Forest Service, U. S. Dept. Agric., in cooperation with the University of Minnesota, at University Farm, St. Paul 1, Minnesota.

[2] All cutting terms as defined in *Forestry Terminology*. Society of American Foresters. 1950.

Then any excess of desirable growing stock trees are marked to be taken out in a thinning cut in young stands or a harvest cut in mature stands. The desirable growing stock levels are those that will result in the maximum growth for a given level of management. The growing stock levels for intensive management with short cutting cycles will be higher than the levels for less intensive management with longer cutting cycles.

Intermediate cuts in young even-aged stands are assumed whenever they are silviculturally desirable and economically possible. Ideally these cuts should be estimated from recommendations made on the ground and based upon growing stock levels, as are the cuts in uneven-aged stands.

Intermediate cuts that are not economically feasible are not included in the allowable cut. Judgment as to economic feasibility is based upon species, products, volume, and accessibility according to local practices.

In even-aged stands, partial area control is needed in the calculation of the final harvest cuts to insure a satisfactory size-class distribution. Therefore the field estimators' recommendations are checked by standard area control calculations. Rigid area control that would require destructive cutting is avoided by setting up a harvest range of main stand ages that would prevent cutting immature stands and would fix the maximum age that overmature timber could be held without appreciable losses.

In some cases it has turned out that allowable cut was practically equal to current annual growth, but usually it is different. Naturally allowable cut is less than growth in young stands, and more than growth in overmature stands. For example, jack pine shows a considerable range of conditions in three Minnesota counties (Table 1).

The growth-allowable cut comparisons for aspen are equally interesting for purposes of analysis (Table 2).

In Clearwater County, the growth figure would indicate that the forest could sustain a greater drain than at present. Actually a large share of the estimated growth is on trees that are just becoming merchantable and will not be ready for harvest cutting during the next 10 years. A meaningful growth-drain or growth-allowable cut ratio depends upon the distribution of age or size classes and the condition of the growing stock. In cut-over, understocked, or young stands, as in this case, the allowable cut is certain to be less than the growth and will give a much better idea of the general forest situation in a county.

TABLE 1.—DRAIN, GROWTH, AND ALLOWABLE CUT OF JACK PINE—MINNESOTA

Item	Itasca County	Cass County	Clearwater County
		Rough cords	
Current drain	30,560	35,540	34,550
Current net growth	15,750	19,480	7,800
Allowable cut	16,780	25,950	5,290

TABLE 2.—DRAIN, GROWTH, AND ALLOWABLE CUT FOR ASPEN—MINNESOTA

Item	Itasca County	Cass County	Clearwater County
		Rough cords	
Current drain	76,810	41,150	35,970
Current net growth	242,590	154,910	56,430
Allowable cut	133,140	76,400	31,200

Other Applications of Allowable Cut Concept

National forests which have need of a 5-year cutting budget and a limitation on timber sales, have been using a system similar to that employed on the regional forest survey. An area allotment scheme is used on even-aged types. A partial cut system related to the growing stock levels indicated by the Lake States basal area guides is used on other types. Growth enters into these cutting budgets only indirectly.

The method has been used also in the management planning for about 2,000,000 acres of county-managed tax-forfeited land in Minnesota. Current practice is to make cutting recommendations for each merchantable stand as it is encountered in the inventory survey. At the completion of the inventory, the allowable cut is calculated. The area and volume of the allowable cut from the calculations are adjusted by selecting additional areas for harvesting or by moving low-priority areas back into the next ten year period. In Wadena and Clearwater counties, which have a good size-class distribution in jack pine, the field recommendations and the calculated cut were practically identical. In other counties the necessary adjustments were easily made by reference to the field recommendations for individual stands. The advantages of this method are that the allowable cut calculations will provide a good estimate of the total cut and prescribe the stands that are to be cut in the next decade. Based upon these allowable cut estimates, the counties are developing an active timber sale program to dispose of timber which they know should be cut, rather than to leave the initiative to timber operators who want to buy particular tracts.

In connection with the Timber Resource Review, long-range estimates will be made of prospective timber requirements, growth goals and periodic allowable cuts along the way to that goal. The Lake States "grass roots" estimates of current allowable cut will provide a good starting point for these calculations. Moreover, insofar as the national goals can be allocated to regions and states (taking account of comparative advantages in each) the local allowable cut estimates will provide a helpful way to distribute those goals.

The growth goal approach may call for altering the intensity of management which might otherwise be applied to forest lands. A comparison of requirements and

potential yields may indicate that intensive forest management is not required on all forest land but should be confined to the better sites, and that extensive management should be given the less productive lands with the sustained yield at a lower level.

Ownership and status of forest management can be determined and taken into account in allowable cut planning. More intensive silviculture and closer utilization can be set up for those lands under management of offset haphazard cutting on other lands.

Summary

A useful expression in evaluating the forest situation locally is an allowable cut which indicates the annual cut of merchantable timber that may be maintained while building toward a desirable level of growing stock and effecting a reasonably even distribution of size classes during the rotation selected for each type.

The traditional growth-drain relationship has limitations in appraising the forest situation nationally and it can be very misleading in local surveys. Growth consistently over-estimates the desirable cut in young stands, and consistently under-estimates it in old stands.

It is practicable to make direct estimates of the allowable cut for the next decade on areas being covered by forest surveys. The estimate of allowable cut can be built up along with the inventory and based upon the present conditions of the stands, ease of logging, the desirable growing stock levels, the estimated growth, and the local objective of management.

A method used in the Lake States for determining the allowable cut provides for progress toward a goal of sustained yield, taking into account the silvicultural and economic aspects of local management and provides a fairly detailed estimate of the area and volume to be cut in the next decade. The Lake States system has been used successfully on national forests in Region 9 and on county forests in Minnesota in setting a cutting budget and in selecting areas to be put up for timber sales.

Physical Changes in Decaying Wood[1]

D. B. Richards
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Small beams from the sapwood of loblolly pine (Pinus taeda *L.*) *were subjected to decay by pure cultures of* Poria monticola *Murr. and* Polyporus abietinus *(Dicks.) Fries; similar beams from the sapwood of red gum* (Liquidambar styraciflua *L.*) *were subjected to decay by pure cultures of* Lenzites trabea *(Pers.) Fries and* Polyporus versicolor *(L.) Fries. Some of the beams were removed and broken in a toughness machine at the end of every 2-week period up to a final decay period of 14 weeks.*

The reduction in toughness due to decay was very rapid with no important difference in the action of the white rot and the brown rot organisms. The brown rot organisms caused noticeable shrinkage on drying whereas the white rot organisms did not.

IT IS WELL KNOWN that decay weakens wood. In the early or incipient stages of decay, the work functions such as toughness, impact bending, and total work are particularly sensitive to the weakening effect of most of the wood decaying fungi. For this reason toughness, which can be measured quickly with standard equipment *(1)*, has been suggested as a laboratory measure of decay *(3, 13, 14)*.

It is also common knowledge that wood in the advanced stages of decay by the brown rot fungi shrinks excessively, particularly upon drying. This has led some to suggest that this shrinkage be used as an index of decay in small blocks *(6)*, even though not all fungi cause such shrinkage *(12)*. The present study was undertaken to compare loss of toughness, shrinkage, and percent weight-loss as possible laboratory criteria of decay *(7, 9)*.

Materials and Methods

Small beams $1\frac{1}{2}$ by $1\frac{1}{2}$ by 6 inches were cut from the kiln dried sapwood of both loblolly pine (*Pinus taeda* L.) and red gum (*Liquidambar styraciflua* L.). These pieces were brought to equilibrium at 7.7 percent moisture-content, weighed, and the original oven-dry weight calculated.

Decay chambers were prepared by placing large-mouth jars (6 by 6 by $8\frac{1}{2}$ inches) on their sides and planting a pure culture of the appropriate fungus on a sterile malt-agar substratum. The brown rot organism *Poria Monticola* Murr. and the white rot organism *Polyporus abietinus* (Dicks.) Fries were used to decay the loblolly pine beams. The brown rot organism *Lenzites trabea* (Pers.) Fries and the white rot organism *Polyporus versicolor* (L.) Fries were used to decay the red gum beams. Eight decay chambers were prepared for each of the above fungi.

The test beams and controls were steamed at atmospheric pressure for 5 minutes. Seven pieces of the appropriate wood were then placed in each of the 32 decay chambers. In each chamber the seven pieces rested on two glass rods 3 millimeters in diameter, which in turn rested directly on the mycelial mat of the fungus.

The decay chambers were placed in a darkened room that was maintained at 80° F. and 80 percent relative humidity. At the end of 2 weeks, one beam from each of the 32 decay chambers was removed. These 32 beams were weighed and measured immediately. They were then broken on a standard toughness testing machine, oven dried and reweighed. From these data the moisture content, decayed wet volume, toughness in inch-pounds, decayed specific gravity, and percent of oven dry weight-loss due to decay were calculated. This procedure was repeated at the end of each 2-week interval until the last set of beams was removed and tested at the end of 14 weeks of exposure to decay. The control beams were brought to a moisture content above the fiber saturation point and tested for toughness without having been subjected to decay. The whole experiment was so designed that any possible effects due to position within the sapwood of the log, differences between decay chambers, or positions within a decay chamber were not confounded with the different decay periods, or different fungi *(7, 8)*.

Results

Moisture content of the decayed wood.—During the progress of decay, the red gum samples accumulated more water than the pine samples. For each wood the samples decayed by the brown rot organism reached a higher moisture content than those decayed by the white rot organism. The highest moisture contents occurred in the pieces decayed by *Lenzites trabea*, while the lowest moisture contents were in the pieces decayed by *Polyporus abietinus* (Table 1). Except for the latter fungus, the percent moisture content of the wood increased markedly with weight-loss and time of decay, suggesting that fungal activity increased the moisture content of the wood.

Volumetric changes.—During the 14-week period of these tests, the wet volumes (above the fiber saturation point) did not show a significant decrease with advancing decay for any of the fungi except *Poria monticola* (Table 1). In this case the volume decreased significantly and curvilinearly with percent weight-loss in accordance with the following quadratic equation:

$$V_d = V_o - 0.040\,W - 0.0002\,W^2$$

V_d = Wet volume after decay by *P. monticola*
V_o = Original wet volume
W = Percent weight-loss due to decay

Noticeable distortion on drying occurred in the test samples decayed by the two brown rot organ-

[1]This research was part of a Ph.D. thesis at the State University of New York College of Forestry and was prepared under the supervision of Dr. R. A. Zabel and Dr. R. R. Hirt.

Table 1.—Average Values of the Physical Properties of Red Gum and Loblolly Pine When Decayed for Various Time Periods by Four Wood-Destroying Fungi. Each Value is the Average of 8 Test Pieces.

Time of decay	Weight-loss	Moisture content	Toughness	Wet volume	Specific gravity
weeks	*percent*	*percent*	*inch-pounds*	*cubic centimeters*	
		Loblolly pine decayed by *Poria monticola*			
0	—	—	153	27.8	.48
2	1.1	32	66	27.6	.48
4	4.0	34	36	27.3	.46
6	6.5	36	42	27.6	.45
8	11.2	44	34	27.4	.43
10	13.9	42	23	27.4	.42
12	16.5	43	13	27.2	.40
14	21.8	47	15	26.6	.39
		Loblolly pine decayed by *Polyporus abietinus*			
0	—	—	142	27.9	.48
2	0.2	29	123	27.6	.48
4	1.4	30	58	27.8	.48
6	3.5	32	45	27.8	.47
8	5.2	32	36	27.4	.46
10	8.3	32	23	27.7	.44
12	10.9	32	20	27.6	.43
14	11.8	32	20	27.4	.43
		Red gum decayed by *Lenzites trabea*			
0	—	—	103	28.6	.43
2	1.7	52	66	28.8	.42
4	4.0	73	78	28.6	.41
6	9.4	82	45	28.6	.40
8	12.9	83	24	28.2	.38
10	13.5	94	19	28.8	.37
12	16.6	93	24	29.0	.37
14	20.0	106	16	28.2	.35
		Red gum decayed by *Polyporus versicolor*			
0	—	—	104	28.6	.43
2	4.4	34	29	28.5	.41
4	5.8	35	26	28.7	.40
6	8.3	36	16	28.4	.40
8	10.6	37	15	28.6	.38
10	14.0	41	14	28.6	.37
12	17.8	54	13	29.1	.35
14	21.4	60	13	28.6	.34

isms.[2] In the case of the pieces decayed by *Poria monticola*, slight distortion on drying occurred at an average weight-loss of 14 percent, moderate distortion at an average weight-loss of 19 percent, and heavy distortion at an average weight-loss of 26 percent. The action of *Lenzites trabea* caused slight distortion at an average weight-loss of 20 percent. Moderate distortion occurred at an average weight-loss of 40 percent. None of the pieces decayed by *L. trabea* showed distortion severe enough to fall in the clasification of "heavy distortion" which was used for some of the *Poria monticola* pieces. The red gum samples with more than 25 percent weight-loss from the action of *L. trabea* generally displayed transverse checking, a condition not apparent in the pine samples.

Specific Gravity. — The initial specific gravity was different for the two woods. The specific gravity of the pine control pieces averaged 0.48, while that of the gum control pieces averaged 0.43 (Table 1). The specific gravity decreased with advancing decay, and, since the volume changes were not very large, this decrease was approximately proportional to the weight-loss percent. It should be noted that pieces with incipient decay can have normal specific gravity and yet have less than one-half the normal toughness value.

Toughness.—The data on toughness are summarized in Table I and in Figures 1 to 3. The average toughness of the control pieces differed for gum and pine, the gum pieces being only two-thirds as strong as the pine. However, because of the greater loss in toughness of the pine samples, the residual toughness value of both woods were similar for badly decayed samples. In the early stages of decay, the toughness was affected similarly by the white and brown rot organisms. In both cases the toughness was reduced very rapidly in the initial phases of decay and then leveled out to give a hyperbolic type curve of toughness versus percent weight-loss (Fig. 1). In order to rectify these curves, the total range of weight-loss values for each fungus was divided into convenient small intervals that included approximately six test pieces each. The mean toughness and weight-loss values of the points in each interval were determined and the coordinates of these average points recorded. Using zero percent weight-loss and the control value of toughness as the known point on each curve, these average points were then rectified by standard empirical methods for hyperbolic type curves *(11)*. The rectification was highly satisfactory in the case of three of the fungi (Figs. 1, 2), indicating hyperbolic type curves of the form $\frac{1}{y+b} = ax + c$.

The equations showing the relationship between toughness and decay are as follows.

P. monticola

$$\frac{1}{T-5.2} = 0.016\,W + 0.007$$

P. abietinus

$$\frac{1}{T-10} = 0.007\,W + 0.008$$

P. versicolor

$$\frac{1}{T-8.1} = 0.018\,W + 0.010$$

[2] The distortion was most noticeable in a view of the end or bottom of the beam. Three arbitrary classifications were set up in order to evaluate the distortion. The term "slight distortion" was used to describe those pieces in which the ends showed a slight departure from the rectangular shape of the controls when a direct comparison was made. The term "moderate distortion" was defined to include those pieces in which the distortion was obvious without direct comparison to the controls. In end view they displayed some taper towards the shrunken bottom edge. The bottom surface was somewhat uneven due to sunken areas. The term "heavy distortion" was used for those pieces with a marked taper of the end view. The bottom surface was cupped or very irregular due to sunken areas.

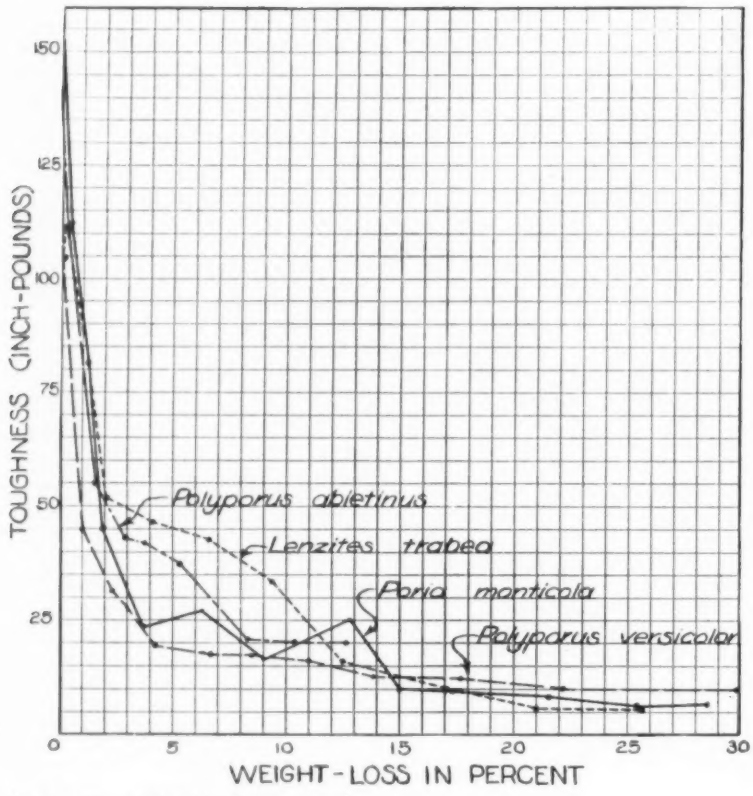

FIG. 1.—The relationships between toughness of the sapwood and percent weight-loss. Each point is the average value of the test pieces in a narrow range of weight-loss values. These ranges of percent weight-loss were arbitrarily selected to include approximately 6 test pieces each. *Poria monticola* and *Polyporus abietinus* were on loblolly pine; *Lenzites trabea* and *Polyporus versicolor* were on red gum.

T = Toughness in inch-pounds
W = Percent weight-loss due to decay

The data for *L. trabea* were not rectified by this technique. This indicates that in decay caused by *L. trabea* the relationship between toughness and percent weight-loss could not be expressed by a hyperbola of the above type.

The second point on the toughness curve for *L. trabea* shows an increase in toughness over the controls of 8 inch-pounds for a weight-loss of 0.2 percent (Fig. 1). Since neither the above weight-loss percent nor toughness is significantly different from the controls, this point (which is the average of 5 test pieces) possibly is due to the chance association of several unusually tough specimens of wood.

In view of the chemical nature of decay, it seems improbable that the fungus actually strengthens the wood. The mechanism of strength reduction appears, however, to be somewhat different in *L. trabea* than in the other three fungi, for even when the irregular point mentioned above is disregarded, the data are not rectified by the technique for hyperbolas that was successful in rectifying the other curves (Fig. 2). If, however, the four irregular points of the curve are ignored and the general trend of the curve followed, an equation can be written that is somewhat similar to those for the other fungi.

L. trabea

$$\frac{1}{T - 0.2} = 0.007\,W + 0.010$$

Except for the irregular action noted above, the fungi reduced the toughness of the wood very rapidly in the early stages of decay. The white rot organisms reduced the toughness versus percent weight-rot organisms in the interval of the first percent weight-loss. On the toughness versus percent weight-

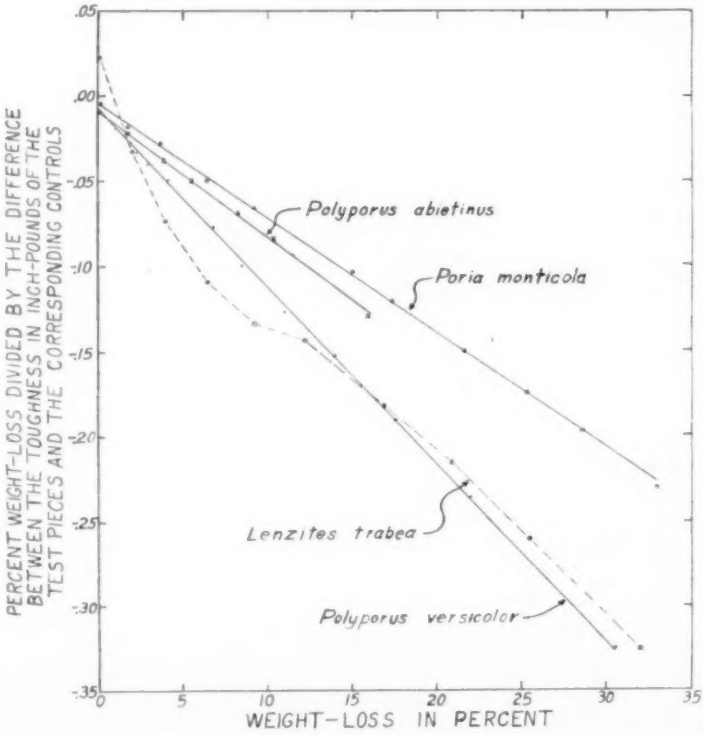

FIG. 2.—Average points from a plot of toughness versus percent weight-loss transformed from hyperbolic to linear form.

loss curve, the average terminal value for the two brown rot organisms was 9 inch-pounds lower than for the two white rot organisms (Fig. 1). Whether or not this small difference is a consistent one is difficult to state, particularly since the decay caused by *Polyporus abietinus* had not progressed far enough to indicate positively whether or not the toughness was actually leveling out at its terminal value. From a practical standpoint these small final differences are of little importance since in the range from 10 to 30 per cent weight-loss by any of the fungi, the wood retained less than one-third and in most cases less than one-eighth of its original toughness. Even at 2 percent weight-loss, the average toughness had in all cases been reduced to 50 percent or less of the corresponding control values (Fig. 1).

The effect of time of decay on toughness is shown in Figure 3. *Poria monticola* and *Polyporus versicolor* appear as the more vigorous organisms with regard to time. This is a direct result of their rapid rate of decay and their marked reduction of toughness for small values of percent weight-loss (Figs. 1, 4).

When the curve of toughness versus time of decay is compared with percent weight-loss versus time of decay, it is noted that toughness is much more sensitive to decay than is weight-loss when short time periods are considered (Figs. 3, 4). The significance of this rapid reduction is somewhat limited, however, by large variations between individual toughness readings and by the necessity of using the method of unpaired differences if any statistical tests are to be used. In spite of these two disadvantages, however, toughness still shows promise as a measure of incipient stages of decay. For example, if the percent weight-loss and toughness values for 2 weeks of decay are studied by the methods for paired and unpaired differences respectively *(5)*, it can be seen that for short time-intervals toughness usually proves to be a more sensitive criterion of decay than does weight-loss (Table 2).

TABLE 2.—A COMPARISON OF THE SENSITIVENESS TO DECAY OF PERCENT WEIGHT-LOSS AND LOSS IN TOUGHNESS AFTER A DECAY PERIOD OF TWO WEEKS

Fungus	Property	Difference being tested	Degrees of freedom	Student's *t*
Poria monticola	Percent weight-loss	1.09	7	2.50*
	Toughness	86.40	14	5.28**
Polyporus abietinus	Percent weight-loss	0.19	7	1.75
	Toughness	20.00	14	0.96
Lenzites trabea	Percent weight-loss	2.76	7	2.30a
	Toughness	38.00	14	2.25*
Polyporus versicolor	Percent weight-loss	4.45	7	3.25*
	Toughness	74.88	14	9.31**

*Significant at the 5 percent level.
**Significant at the 1 percent level.
aGreater than the 10 percent probability level.

In the case of decay caused by *Polyporus abietinus*, neither of the criteria indicates significant decay in a 2-week period. Since the variation is in the accepted direction in each case (reduction in toughness and increase in weight-loss), the 10 percent probability level could possibly be used to demonstrate the same significance that is usually attributed to the 5 percent level. For decay caused by *P. abietinus*, however, neither toughness nor weight-loss shows significance even at this 10 percent level (Table 2).

Differences between the four fungi.—The rate of weight-loss differed somewhat with the different fungi used. In considering early trends *Polyporus versicolor* was the most vigorous organism, producing over 4 percent weight-loss in 2 weeks. *Polyporus abietinus* on the other hand was very slow in getting started and produced

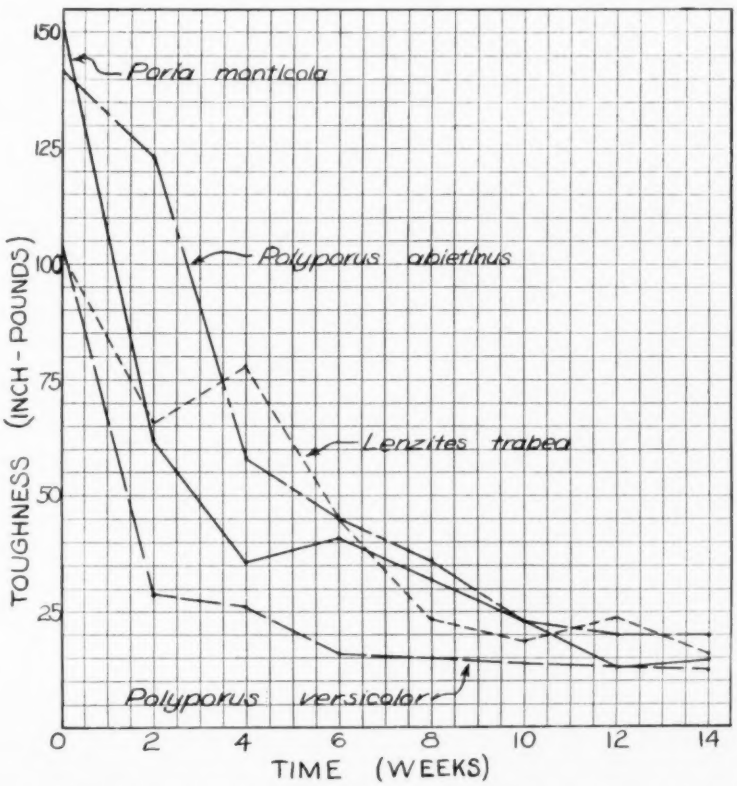

FIG. 3.—The effect of time of decay on toughness. Each point is the average of 8 test pieces. *Poria monticola* and *Polyporus abietinus* were on loblolly pine; *Lenzites trabea* and *Polyporus versicolor* were on red gum.

scarcely any effect in the first 2 weeks (Fig. 4, Table 1). For the full 14-week period, 3 of the fungi caused similar weight-losses per unit of time, but *Polyporus abietinus* decayed the wood much more slowly than the others. This lower rate of decay was partially but not entirely due to the slow start of *P. abietinus*. For the 14-week period, the rate of decay by *P. abietinus* was 56 percent of the average rate of the other three fungi. If, to eliminate early differences, the rate during the period from 2 to 14 weeks is considered, *P. abietinus* still has a rate of decay only 62 percent as great as that of the other three fungi.

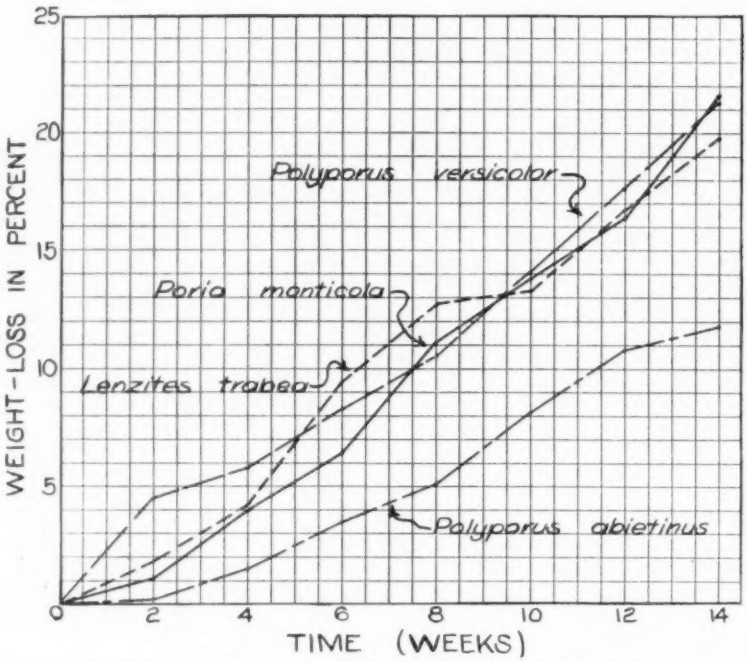

FIG. 4.—The relationships between percent weight-loss and the length of the decay period. Each point is the average of the value of 8 test pieces.

Discussion and Conclusions

Volume.—The volume of the test pieces was not reduced even in the more advanced stages of decay caused by white rot fungi. This result is in agreement with the work of Scheffer *(12)*.

One of the brown rot organisms, *Poria monticola*, caused significant reduction in the wet volume, while the other, *Lenzites trabea*, caused no such effect. The shrinkage caused by *Poria monticola* is in agreement with the usual laboratory experience with brown rots. The lack of volume changes after decay by *Lenzites trabea* is not in agreement with the usual experience with this organism. When small blocks are subjected to extensive decay by this organism, they generally become shrunken and distorted on drying *(6)*. The two specimens most severely decayed by *L. trabea* (weight-loss of 34 and 47 percent, respectively) showed moderate distortion upon drying. Some of the specimens with lower weight-losses showed a small amount of distortion on drying, but none of this shrinkage was significant enough in the wet specimens to show in a statistical study of the wet volume. While earlier changes may affect the volume after drying, it must be concluded that the wet volume of red gum is not affected appreciably by *L. trabea* unless decay progresses beyond 25 to 30 percent weight-loss.

Toughness.—In general, toughness of the wood proved to be a more sensitive measure of decay than weight-loss. As a measure of decay, toughness has two important advantages over weight-loss. First, it is more sensitive to the effect of decay, being reduced markedly after short decay periods, and second, it gives direct evidence when the wood has been weakened enough to reduce its utility. The need for straight grained decay specimens at least 5 inches long and for a special testing machine detracts somewhat from the general usefulness of toughness as a criterion of decay in wood.

There was no consistent difference between the white and brown rot organisms in their effect on toughness. In the past many of the studies of the effect of decay on strength have been made on wood which was decayed in the living tree by heartrot organisms. Because of its great economic importance, *Fomes pini* has often been used as a white rot in such studies, even though its effect on wood is not comparable to that of other white rot fungi *(4, 15)*. The early losses in strength due to rot by this organism are not marked *(2, 10, 13)*. In the past this information has sometimes led to the generalization that incipient decay by a white rot organism has very little effect on strength in comparison to incipient decay by a brown rot organism. This generalization does not hold for the fungi employed in this study, since in the early stages of decay the white rot organisms *(Polyporus abietinus* and *Polyporus versicolor)* reduced the toughness as rapidly as the brown rot organisms (Fig. 1). In view of these results, the foregoing generalization can no longer be accepted but rather each fungus must be studied individually to determine its effect on the physical properties of wood.

Summary

Small beams of red gum and loblolly pine were subjected to decay by white and brown rot organisms for various decay periods up to 14 weeks. Physical properties of the decayed wood, including volume, moisture content, percent weight-loss, and toughness were studied for different time periods.

Of the four fungi used, only *Poria monticola* reduced the wet volume of the wood significantly. The other brown rot fungus, *Len-*

zites trabea, caused some shrinkage of the wood upon drying but none could be detected while the test pieces were still wet.

Toughness was a more sensitive measure of early decay than percent weight-loss. When plotted against percent weight-loss, the toughness curve was generally hyperbolic in form. There was no consistent difference between the white rot and brown rot organisms in their effects on toughness.

The moisture content was affected by decay. In general, the moisture content increased with advancing decay, but the rate at which it increased was different for the different fungi.

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Poisoning Versus Girdling to Release Underplanted Pines in North Mississippi

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The South has a huge acreage of forest in which release from undesirable hardwoods is essential for the development of understory pine, whether planted or natural. This article reports on a test of two methods of accomplishing such release.

IN 1948, the Southern Forest Experiment Station installed a study to compare the effectivenes of Ammate poisoning and of girdling as means of releasing underplanted loblolly pines in north Mississippi. Except that it had been underplanted, the experimental tract was a depleted hardwood stand typical of many upland forests in the vicinity.

The Study Area

The study area, in Panola County, Miss., is a relatively dry site with brown loam soil. Before treatment, it supported a low-quality stand composed principally of blackjack oak with a few white and post oaks, red and black oaks, hickories, and black gum. This overstory averaged 228 trees per acre more than one inch in diameter. Of this total, 102 were 4 to 9 inches and 36 were 10 inches or larger in diameter. The average was almost 7 inches.

In early 1941, Colonel J. W. Canada, who then owned the land, underplanted the hardwoods with about 1,200 loblolly pines per acre. By October 1948, after eight growing seasons, survival averaged 52 percent, or about 628 pines per acre. The survivors were generally of low vigor, averaging only 1.1 inches d.b.h. and 10 feet in height. The 100 tallest pines per acre averaged 2.0 inches d.b.h. and 15 feet tall. In contrast, local old-field plantations of the same age usually average around 3 inches in diameter and 20 feet in height, with 70 percent or better survival.

Treatments

Nine quarter-acre plots, each surrounded by approximately half-acre isolation strips, were established in October 1948. Data on the growth response of pine are from the interior quarter-acre plots; hardwood mortality, sprouting, and pine damage data are from the plots plus the surrounding isolation strips.

These treatments were replicated three times, with assignment of treatments to plots being at random. On three plots all hardwoods 1½ to 3½ inches d.b.h. were felled. The ax cuts were made so as to leave a stump with a tulip-like top. Ammate (ammonium sulfamate) crystals were applied to the freshly cut surfaces at a rate of one tablespoonful on the smaller and two on the larger stumps. Hardwoods larger than 3½ inches d.b.h. were treated by the Ammate crystal-in-notch method. Notches were chopped just above the ground line at a spacing of 6 inches between centers, and one tablespoonful of crystal was applied to each notch.

On three other plots hardwoods 1½ to 3½ inches d.b.h. were severed and the stumps left untreated. Larger trees were given a single-hack girdle (frill) made by overlapping ax cuts around the tree at a convenient chopping height. No chemicals were applied to the frills.

The last three plots were left untreated as a check.

Results

Overstory mortality.—The death of at least ⅔ of the crown was the criterion for judging whether non-severed hardwoods had been killed. Over a 32-month period, frill girdling was the most effective; it killed 99 percent of the overstory hardwoods while Ammate killed only 81 percent. The difference of 18 percent in favor of frill girdling was highly significant according to a chi-square analysis.

The effectiveness of frilling for crown-kill varied little among the species treated. Poisoning, on the other hand, was most effective on blackjack oak and least on hickory. Table 1 summarizes results by species.

Rapidity of death may in some instances be an important factor, and in this respect poisoning showed some advantage. Eighty-five percent of the poisoned trees that died during the 32-month period did so within the first 12 months. Girdled trees died more slowly; only 54 percent of the total mortality occurred during the first year.

Sprout control.—The underplanted pines on the study plots were, in general, large enough to withstand the competition from hardwood sprouts induced by treatment. With small pines, however, sprouting of treated hardwoods is often a serious problem, particularly where the overstory hardwoods are young (and therefore likely to sprout vigorously).

Table 1 also shows that a greater percent of trees poisoned with Ammate lacked live sprouts than was the case where trees were girdled without poisoning. Although poison effectively inhibited sprouting in all species, hickory was slowest to succumb. Among girdled trees, the lowest percent of sprout control occurred in hickory.

It is apparent from Table 2 that poison was effective in sprout control on all sizes of trees down to 3½ inches, but that girdling became notably less effective as size diminished. Complete data could not be obtained on severed trees smaller than 3½ inches d.b.h.; but after 21 months, only 5 percent of the unpoisoned stumps were free of sprouts, whereas 59 percent of the poisoned stumps were sproutless. As might be expected, sprout control was least effective on the smallest trees and stumps. The control improved with time, even after the first 2 years regardless of whether poisoning, girdling, or severing had been used.

[1]Maintained by the Forest Service, U. S. Dept. Agric., in cooperation with the University of Mississippi.

TABLE 1.—PERCENT, BY SPECIES, OF TREATED HARDWOOD TREES (LARGER THAN 3½ INCHES D.B.H.) RESPONDING FAVORABLY (JUDGED BY DEATH OF AT LEAST ⅔ CROWN OR BY ABSENCE OF LIVE SPROUTS), AT VARIOUS TIMES AFTER TREATMENT

Species and treatment	Hardwoods treated	Crown kill				Sprout control		
		At 6 months	At 12 months	At 24 months	At 32 months	At 12 months	At 21 months	At 32 months
	Number	*Percent with dead crown*				*Percent without live sprouts*		
Blackjack oak:								
Poisoned	292	42	77	85	87	99	96	100
Girdled	228	11	58	97	99	52	38	58
White and post oaks:								
Poisoned	29	12	32	54	61	100	100	100
Girdled	35	0	24	76	97	75	68	71
Red and black oaks:								
Poisoned	20	25	37	45	40	100	89	100
Girdled	34	15	57	97	97	73	67	77
Hickories:								
Poisoned	9	15	14	15	11	92	78	100
Girdled	25	15	56	89	100	70	65	72
All species:								
Poisoned	350	38	69	77	81	99	96	100
Girdled	322	16	54	94	99	58	47	62

Chi-square tests indicated that the differences in sprouting between treatments were highly significant for each size class except that including trees larger than 12½ inches d.b.h.

Growth of underplanted pine.—In the two years following release, diameter, height, and basal area growth differed significantly between released and unreleased pines. The diameter growth of released pines averaged about twice and the height growth about 1½ times that of the unreleased pines (Table 3). Basal area growth per acre of the released pines was more than twice that of the unreleased pines.

Analysis of growth data reveals little to choose between results of poisoning or girdling. However, the diameter growth of the 100 tallest pines per acre released by girdling was significantly better than that of the 100 dominants released by poisoning.

Other recent studies have shown that underplanted pines grow much faster when released immediately after planting than when release is delayed. Early release is considered better, but these pines responded well to release 8 years after planting.

TABLE 2.—PERCENT, BY SIZE, OF TREATED HARDWOOD TREES (LARGER THAN 3½ INCHES IN D.B.H.) RESPONDING FAVORABLY (JUDGED BY ABSENCE OF LIVE SPROUTS)

D.b.h. and treatment	Time since treatment		
	12 months	21 months	32 months
	Percent without live sprouts		
3½ to 8½ inches:			
Poisoned	100	97	100
Girdled	44	30	46
8½ to 12½ inches:			
Poisoned	100	92	100
Girdled	77	73	89
Larger than 12½ inches:			
Poisoned	100	96	100
Girdled	100	90	97

Damage to underplanted pines.—Many underplanted pines were damaged by the fall of treated hardwoods. Much of the damage to date has resulted from the fall of entire treated trees that broke at the point of girdling or notching. Almost nine-tenths of the girdled and all of the poisoned trees that broke at the point of treatment were less than 9 inches d.b.h.

Thirty-two months after treatment, an average of 57 pines per acre, or 9.1 percent of the original pine stand, had been killed or severely damaged by falling stems or branches of poisoned trees. Under the girdled overstory, 52 pines per acre—7.7 percent of the original pine stand—were killed or severely damaged. The difference of 1.4 percent between treatment is not statistically significant.

Much of this damage probably could have been eliminated by more shallow girdling or notching. However, many such dry-ridge hardwoods, especially blackjack oaks, are so doty that any girdle deep enough to kill the tree severely weakens it.

The heavy damage to the underplanted pine is believed to be due

TABLE 3.—TWO-YEAR GROWTH RESPONSE OF 8-YEAR-OLD UNDERPLANTED PINE TO RELEASE

Item	D.b.h.			Height			Basal area per acre		
	1948	1950	Increase	1948	1950	Increase	1948	1950	Increase
	Inches			*Feet*			*Square feet*		
Average of all pine:									
Unreleased	1.2	1.8	0.6	10.8	14.8	4.0	6.2	11.7	5.5
Released by poisoning	1.0	2.0	1.0	9.0	14.2	5.2	5.1	16.3	11.2
Released by girdling	1.2	2.3	1.1	10.1	16.2	6.1	7.1	22.9	15.8
100 tallest pines per acre:									
Unreleased	2.0	2.7	0.7	15.0	20.5	5.5	2.2	4.0	1.8
Released by poisoning	1.9	3.2	1.3	14.4	20.3	5.9	2.0	5.6	3.6
Released by girdling	2.2	3.7	1.5	16.2	23.4	7.2	2.6	7.5	4.9

largely to the 8-year delay in release. Pines released when planted are much smaller, more flexible, and less likely to be damaged when the deadened overstory disintegrates.

Treatment costs.—Frill girdling the trees more than 3½ inches d.b.h., plus cutting those smaller, cost $3.60 per acre. Poisoning with Ammate cost $8.38. Table 4 shows the average number and size of trees treated, the man-hours of labor required, the total charge for labor at $0.75 per man-hour, the amount of Ammate used, and the total cost of Ammate at $0.20 per pound.

Although based on only a limited area, these costs are very close to those of other investigators[2] reporting results of treating larger areas.

TABLE 4.—TREATMENT COSTS PER ACRE

Treatment	Hardwoods treated per acre	Average d.b.h.	Basal area per acre	Cost per acre	
	Number	*Inches*	*Sq. ft.*	*Man-hours*	*Dollars*
Not poisoned:					
Girdled	133	8.6	53.2	—	—
Severed	103	1.5	1.2	—	—
Total	236		54.4	4.8	3.60
Poisoned:					
Notched	146	8.4	56.9	—	—
Severed	62	1.7	1.0	—	—
Total	208		57.9	7.3	8.38[1]

[1]Includes the cost of 14.5 pounds of Ammate at $0.20 per pound.

Summary

Undesirable overstory hardwoods, principally blackjack, post, red, and black oaks and hickories were treated by frill girdling and by the Ammate-in-notch system of poisoning to release 8-year-old underplanted loblolly pine. The principal findings were:

1. Single-hack frill girdling gave a more complete crown kill on upland oaks and hickories and cost less, but was slower in killing than Ammate poisoning.

2. Ammate poisoning was more effective in preventing sprouting than was frill girdling or felling without application of Ammate.

3. With or without application of Ammate, small trees sprouted much more prolifically than large trees.

4. During the two years following treatment, released pines outgrew those not released. Differences in the average growth of all pines between poisoned and frill-girdled plots were not statistically significant.

5. Almost one-tenth of the underplanted pines were killed or severely damaged by falling stems or branches of deadened trees. This heavy damage is believed largely due to the 8-year delay in release.

[2]Campbell, R. S., and F. A. Peevy. Chemical control of undesirable southern hardwoods. Jour. Range Mangt. 3:118-124. 1950.

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Anatomy and Morphology of the Seedling Roots of Four Species of the Genus Quercus

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Over the deciduous forest area of the eastern United States much of the oak has been removed while the less desirable species such as hickory and ash have been left. Because of their lighter wind-blown seeds, many other species have an advantage over oaks in the regeneration which takes place in cutover areas. However, since the oaks are one of the more valuable elements of the eastern hardwood areas, any practice which increases their frequency in regeneration is to be desired. Planting of oak in such areas would seem the logical solution to this problem but unfortunately in the past these plantings have been only partially successful. It was hoped that a more detailed study of the structure of the oak seedling might contribute to a better understanding of methods for re-establishing the valuable members of this genus.

To the present time, much work has been done on the cultural aspects of producing oak seedlings. Studies of acorn collection, storage, germination, and planting have been made. Numerous investigations of survival of oak plantations are to be found in the literature. Direct seeding has been tried many times, and is still being recommended. The basis for recommending direct seeding is the poor success obtained from planted nursery stock.

In the past the emphasis has been on the study of the shoot structure almost entirely. The basic concepts of dominance, vigor, and site have been based largely upon observations of the crown and bole. Ecologists and taxonomists have long recognized the wide variations in site requirements for different species of oak. These requirements are reflected in such common names as: swamp white oak, swamp chestnut oak, water oak, and canyon live oak.

The anatomy of the mature wood of oak has been carefully studied by Betts *(1)*, Eames *(6)*, Tippo *(12)*, and Williams *(15)*. Davey *(3)* has investigated the vascular transition of three European species, but to the knowledge of the authors no work exists on the anatomy of the primary root of the North American species.

Several excellent papers have been written on the morphology of the roots—Toumey *(13)*, Korstian *(9)*, DenUyl *(4)*, Holch *(8)*, and Weaver *(14)*—but the detailed developmental anatomy of the oak roots has not been done.

This study was initiated: (1) to describe the morphology and anatomy of the young roots of four species of oak; (2) to determine, if possible what effect soil type has on the structure of young oak roots; and (3) to determine if the reason for the lack of success in planting oak can be found in the structure of the roots of young seedlings.

Methods

The four species used in this investigation were: *Quercus alba*, *Q. bicolor*, *Q. rubra*, and *Q. palustris*.

Q. alba and *Q. bicolor* of the sub-genus Leucobalanus were selected for comparison with *Q. palustris* and *Q. rubra* of the Erythrobalanus sub-genus.

Q. bicolor and *Q. palustris* are species of a swamp habitat, and are compared with *Q. alba* and *Q. rubra* which are species of a mesophytic habitat.

The two soil types chosen were Oaktown loamy fine sand and Brookston silty clay loam. These soils were very different in structure and in nutrient levels. The Oaktown soil was collected from a forested area, and the Brookston was collected from a pasture lot.

The acorns were collected from single trees to make certain of the species identification, and to eliminate as much as possible the genetic influence in mixed seed from scattered sources.

The acorns of *Q. alba* and *Q. bicolor* were planted as soon as collected. The acorns of *Q. rubra* and *Q. palustris* were stratified in moist river sand at 4°C for 120 days prior to planting. The original planting of *Q. rubra* made in 1950 failed to germinate because of insect damage and poor storage conditions, and a second crop of acorns was collected in October 1951. In order to complete the problem as scheduled, Deuber's method *(5)* of shortening the rest period of red oak acorns was tried with complete success. The acorns were stratified for 30 days and subjected to ethylene chlorohydrin fumes for 24 hours and then germinated. The germination obtained by this method was 96 percent.

Data from the literature and from field observations of one-year-old seedlings indicated that one season's root growth and penetration might be as much as 18 inches. In order to secure normal roots for study, a container for growing the seedlings was devised. The container consisted of a 24-inch length of 7-inch galvanized stove pipe. The pipe comes with a preformed flange which holds the tube together. The joining flanges were not crimped so that the sections of pipe could be easily opened for removal of the roots. The sections of pipe did not rust or corrode easily, although they were used several times.

Collections were made at fortnightly intervals after one month. The plants were removed intact by unfastening the edge flanges and soaking the whole planting tube in a deep tub of water. The condition of the roots and length was recorded at the time of collection. The roots were removed from the shoots; killed and fixed in F. A. A. for further morphological and anatomical study.

Investigations of naturally occurring seedlings were also carried out to check the validity of the data obtained from the greenhouse-grown material.

[1]Department of Forestry and Conservation, and Department of Biological Science respectively.

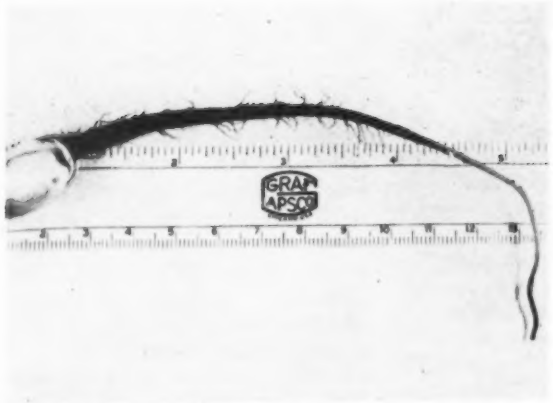

FIG. 1.—The hypocotyl-root of a 14-day-old *Q. alba* seedling.

FIG. 2.—Development of shoots from the axillary buds of the cotyledons after excising the epicotyl.

Morphological Development During the 1st Month

Quercus alba.—At the end of ten days the average length of the hypocotyl-radicle was 10 cm. Phellogen formed early in this species, producing cork which extended down the root for 5 cm. This cork was characteristically brown and highly fissured. A few scattered secondary roots were observed developing from this corky region. By the 14th day the average length of the hypocotyl-radicle was 17 cm. and formation of secondary roots was profuse. One 14-day-old hypocotyl-radicle had developed over 100 secondary roots which were themselves branched. All the secondary roots produced were confined to the corky region of the radicle (Fig. 1). At one month the hypocotyl-radicle averaged 26 cm. in length. In many of the seedlings there was a noticeable increase in diameter of the hypocotyl-radicle below the cotyledonary nodes. The cork formation was very heavy and covered all the root except near the growing tip. The secondary roots were found to have root hairs, although none were found on the primary root.

It was observed that whenever the epicotyl of one of the young seedlings was damaged, two new shoots appeared. As a matter of experimental curiosity the young epicotyl of a 14-day-old seedling was removed and the plant allowed to grow. This was done to stimulate the development of the auxiliary cotyledonary buds by removal of the terminal bud influence. Ten days after removal of the epicotyl, two shoots were observed which had developed from the auxiliary buds of the cotyledon petioles (Fig. 2).

Quercus bicolor.—These acorns germinated more slowly than those of the *Q. alba*, requiring 24 to 30 days. The rates of hypocotyl-radicle elongation of *Q. bicolor* were similar to the rates of elongation for *Q. alba*. The average lengths of the hypocotyl-radicle for the various periods were as follows: 10 days—9 cm., 14 days—16 cm., and 30 days—23 cm. There was no apparent enlargement in diameter of the corked-over hypocotyl as was the case in the *Q. alba* seedlings. There was, however, a gradual tapering from the cotyledonary node to the tip. Branch root formation was limited to the corky area of the hypocotyl. No branch roots were observed below this corky region. There was very little branching of the secondary roots of *Q. bicolor* at one month of age (Fig. 3).

Quercus rubra. — The rate of elongation of the hypocotyl-radicle was on the order of 1 cm. per day for the first month, which is approximately the same rate as was observed for *Q. alba* and *Q. bicolor*.

The cork formation was much less than in the Leucobalanus subgenus and at no time during the first month was the radicle as highly corked over as that of *Q. alba*. *Q. rubra* produced many more secondary roots which were much branched and covered with fine root hairs (Fig. 4).

The elongation of the cotyledon petioles of northern red oak takes place after the radicle has become established and in many instances caused the acorn to be lifted from the soil. This phenomenon was not observed for any of the other species investigated.

Quercus palustris.—The development of the radicle during the first month was initially slower than the other species investigated, but the average length attained at one month was 26 cm. which compares favorably with the average total length of the other species. Cork formation in pin oak was least of any of the four investigated, and the root hair formation was the greatest. There were fewer secondary roots formed by pin oak than by red oak but those formed were much longer and more branched than those of any other species. In general the radicle has a very gradual taper from the cotyledonary node to the tip, and it was smaller in diameter than that of any of the other oaks investigated (Fig. 5).

Morphological Differences Due to Soil Type

The most striking morphological difference between plants grown on the Brookston and Oaktown soils was in the size and number of branch roots. Plants from the Brookston soil developed normal branch roots which were long and

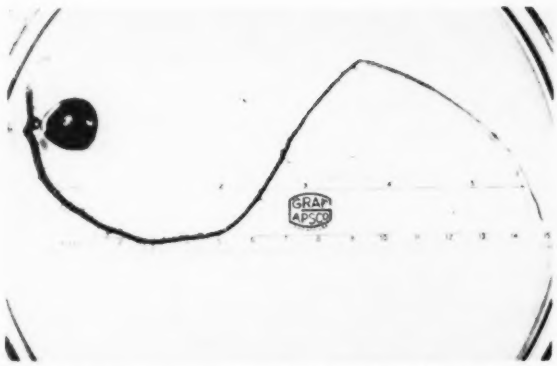

Fig. 3.—Primary root of *Q. bicolor* one month old showing gradual taper of primary root and branch root development.

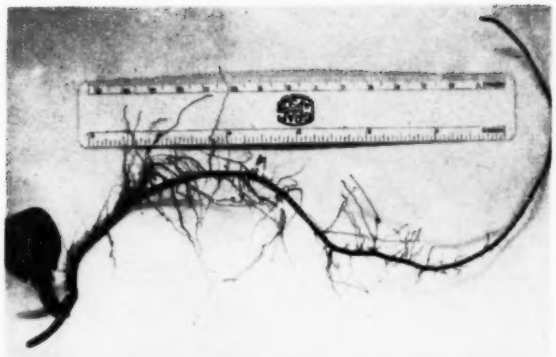

Fig. 4.—Primary root of *Q. rubra* 28 days old with numerous branch roots.

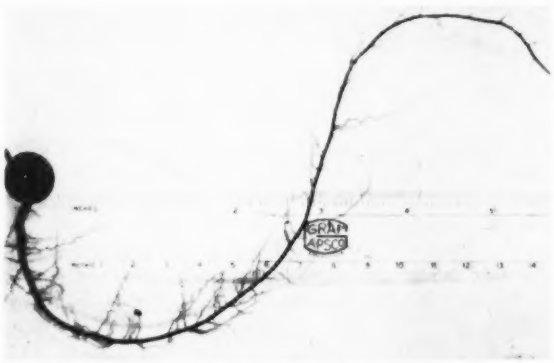

Fig. 5.—Primary root of *Q. palustris* 28 days old.

Fig. 6.—Comparison of branch roots of *Q. alba* seedlings grown on different soils. *A*, Normal branch roots from plants grown on Brookston soil. *B*, Mycorrhizal roots developed on plants grown on Oaktown soil.

tapering, while those plants grown in the Oaktown soil developed very different branch roots which were short and thick. These short, thickened branch roots originated close to the primary root tip, and in many cases they were larger in diameter than the primary roots at their point of origin (Fig. 6). No root hairs were observed on these branch roots. Observation showed these roots to be mycorrhizal in nature; they appeared very similar to those described by Hatch *(7)* for pine.

Quercus alba.—*Q. alba* developed a longer tap root when grown in Brookston than when grown in Oaktown sand. In many cases the tap root elongated as much as 5 cm. per week. On both soils there was a high percentage of tip rotting. Whenever the primary root tip was destroyed by rot or injury, the branch roots or branch root assumed dominance, producing a widespread much-branched type of root system. This modification of roots due to injury has been observed and described by Korstian *(9)* and DenUyl *(4)* for red and white oak. Coincident with the formation of a lateral root system due to destruction of the primary tip, there was extreme enlargement of the primary root below the cotyledonary node. In some instances the root system consisted of a short swollen segment (collar) of the primary root from which radiated many branch roots.

Quercus bicolor.—The roots of *Q. bicolor* were much thinner and did not attain the length of those of *Q. alba*. In contrast to white oak, swamp white oak produced deeper tap roots when grown on the Oaktown soil than on the Brookston. The incidence of tip rot was very high on both soils but was more severe on the Brookston.

Quercus palustris.—*Q. palustris*, despite the small cotyledon size, produced a relatively large and stout root system. Tip rotting was quite prevalent on both soil types and none of the plants grew four months without injury and death of the tips.

Quercus rubra.—The root system

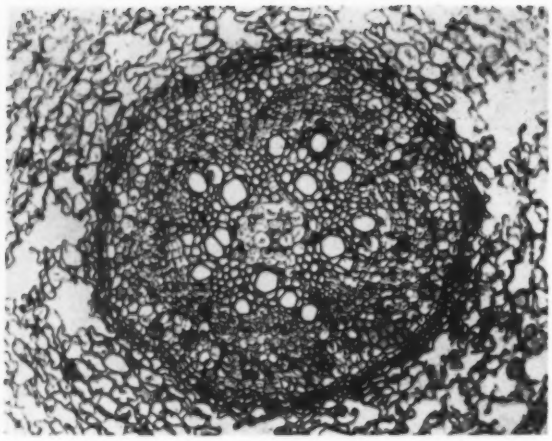

FIG. 7.—Cross section of primary root of *Q. alba* 20 cm. below the collet.

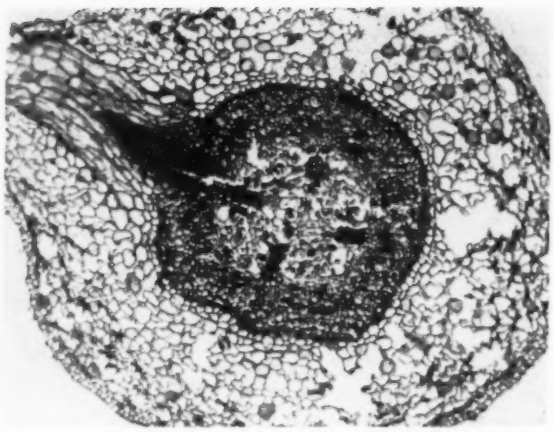

FIG. 8.—Cross section of primary root of *Q. alba* 35 cm. below the collet. Note development of cork cambium.

of *Q. rubra* was similar to that of *Q. palustris* with respect to tip rotting and branch root formation. The cork formation and diameter growth of *Q. rubra* roots were greater than *Q. palustris*. The root system of northern red oak was more branching than any of the other species investigated. Many of the branch roots were very large and were covered with cork at the end of four months.

Anatomy of Two-Months-Old Roots

Q. alba.—Two-months-old primary roots of *Q. alba* were characterized by the extremely large parenchymatous pith present in the upper portion of the root. This pith occupied 75 percent of the total cross sectional area of the root 1 cm. below the collet. Interfascicular cambium activity produced abundant derivatives, but very few matured into conducting elements. Most of the secondary cambium derivatives remained parenchymous, forming wide vascular rays.

At progressively lower levels there was less secondary tissue present, but the structure of the root was not fundamentally different from that of the first cm. below the collet. At 20 cm. below the collet the pith was still present, surrounded by the primary and secondary xylem. The phellogen layer was present and the cortical tissue was in the process of disintegration (Fig. 7).

Thirty-five cm. below the collet the root consisted of epidermis, cortex, endodermis and phellogen, surrounding a tetrarch protostele with a small pith. The phellogen developed in the pericycle before the formation of the vascular cambium (Fig. 8).

Fifty cm. below the collet and 1 cm. above the root tip, the primary root was tetrarch with no pith. The primary xylem had matured all the way into the center, and the center of the root was occupied by a large metaxylem vessel (Fig. 9).

Q. bicolor.—This species was similar to *Q. alba* in that there was a large and persistent pith present which occupied the larger part of the primary root. There was not the abundance of stored carbohydrates in the parenchyma cells of *Q. bicolor* that there was in *Q. alba*. The phellum cells were high-

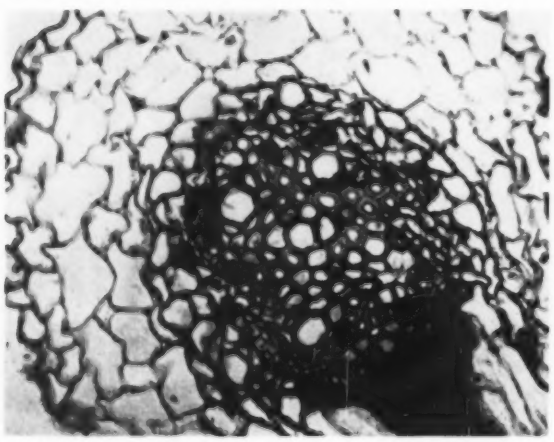

FIG. 9.—Cross section of primary root of *Q. alba* 1 cm. above the root tip.

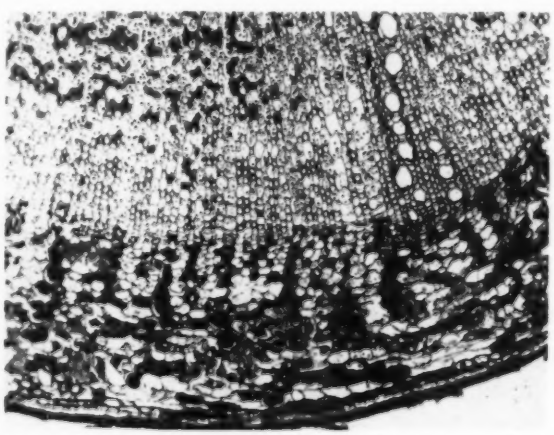

FIG. 10.—Cross section of two-months-old *Q. palustris* root.

ly suberized and the phelloderm cells were filled with tannins. Near the root tip the root was hexarch and there was no pith present.

Q. palustris.—Unlike other species investigated, pin oak did not produce a large or extensive pith. The upper portion of these roots was characterized by the extreme amount of secondary tissue. There was almost no primary tissue present in a two-months-old pin oak root. The pith was very small and did not extend down the root more than 4 cm.

The primary root was hexarch and the pith and primary phloem made up about 20 percent of the cross sectional area at the collet. The remainder of the root consisted of secondary xylem, phloem and phellum (Fig. 10). Although the primary root was hexarch, all the branch roots were tetrarch. Presence of cambium in a branch root only 300 microns in diameter indicated early development of secondary tissue.

The secondary xylem was mostly parenchymous, being composed of thick-walled storage cells. These cells were not arranged in rays but occupied wide segments of the root between the true xylem rays. Many of the cambium derivitives differentiated into fibers and tracheids, and a few became vessels. The fibers were of two types—a lignified type and a gelatanous type, in which the secondary walls are composed of cellulose.

Q. rubra.—The structure of the primary root was intermediate between *Q. alba* and *Q. palustris*. A large pith similar to that of *Q. alba* was present; however, much more secondary xylem similar to *Q. palustris* was produced. The primary structure 1 cm. below the collet was hexarch and similar to *Q. palustris*. The pith present was composed of thin-walled parenchyma cells which contained stored carbohydrates. The secondary xylem consisted of the same three types of cells as were found in *Q. palustris*. The pericycle and phelloderm were parenchymous and there were very few fibers present in these tissues.

At progressively lower levels there was a gradual reduction of the size of the pith present.

Twenty cm. below the collet, a pith was still present in the root and it was surrounded by the primary and secondary xylem. A well-developed phellogen and two layers of suberized phellum separated the pericycle from the endodermis and cortex.

Discussion

The morphological characteristics of the roots observed agree in general with the previous findings of DenUyl *(4)*, Toumey *(13)*, and Lunez *(10)*. All of the species investigated were characteristically tap-rooted but in most cases the tap root did not persist, and a secondary root system developed. The formation of a true tap root (extension of the radicle) was a very rare occurrence. The reports of extremely long tap roots for this genus may not have been based on the strict morphological definition of a tap root. Weaver *(14)* describes the tap root of mature *Q. macrocarpa* as being very crooked and twisted. Probably this was not a true tap root, and each bend or twist was due to the death of the root apex and the consequent downward penetration of a secondary, closely associated with the tip.

The diameter of the root seems to be correlated with the size of the cotyledon. In the case of *Q. alba*, the large cotyledons may possibly supply more carbohydrate than the smaller cotyledons of *Q. bicolor*, thus producing the difference in root diameter. This seems indicated when one considers the fact that death of the meristematic regions of the root causes abnormal diameter enlargement of the roots from the large fruited species, while there is not the noticeable enlargement in diameter of the roots for the small fruited species.

The most consistent and striking morphological difference associated directly with the soil type was the presence of mycorrhyzae. All plants grown in the "forest" Oaktown soil produced mycorrhizae, whereas none of the plants grown in the "pasture" Brookston soil were found to have mycorrhizae. The effects of the mycorrhizae on the growth and vigor of the seedlings were not apparent, but the fact that mycorrhizae do not occur on plants from non-forested soils may be a clue to the poor success of planted oak on old-field sites.

The inhibitory effect of the terminal bud on the development of the axillary cotyledonary buds was shown, and doubtless many of the references to "root sprouting" of oak after shoot damage may be attributed to the development of the axillary cotyledonary buds, rather than to the formation of adventitious buds on the roots. Occurrence of adventitious buds on the roots was not observed.

On the basis of morphology and anatomy it would appear that with present accepted nursery practices, one would have little success in transplanting any of the species examined. *Q. alba* would probably be the most difficult to transplant because it produces very few functional laterals, and is very heavily corked over. If cork is as impenetrable to water as is currently assumed, then there is very little absorptive area on a one-year-old *Q. alba* root. On the other hand, *Q. rubra*, *Q. palustris* and *Q. bicolor* produce a more branching type of root system which is less suberized, and should therefore have more absorbing area. Ranked in descending order of morphological adaptability for transplanting the four species would be: *Q. palustris*, *Q. rubra*, *Q. bicolor*, and *Q. alba*. These findings agree with the existing planting information. Chittenden *(2)* and Tillotson *(11)* both recognize the difficulty associated with transplanting *Q. alba*, and they recommend direct seeding in preference to transplanting nursery stock. It seems possible that better transplanting stock could be produced by arresting the development of the tap root, thereby stimulating the formation of a lateral root system. This might be accomplished by cutting the tips from the radicles of germinated seeds before planting. This method was not tried, but an investigation of this nature is contemplated by the authors.

The soil type apparently has little effect on very young seedlings,

probably because there is sufficient nutrient material in the large cotyledons to supply the needs of the plant through the first growing season.

Summary

1. The anatomy and morphology of the young primary roots of *Q. alba*, *Q. bicolor*, *Q. rubra*, and *Q. palustris*, as effected by two different soil types has been described.

2. Wide morphological differences exist between the species, which seem to be correlated in part with acorn size.

3. The plants grown on the Oaktown forest soil were universally mycorrhyizal, whereas plants grown on the agricultural Brookston soil were not.

4. In all the species examined there was a very early initiation of phellogen. In many instances phellum was present before the initiation of branch roots from the pericycle.

5. A pith is present in all the primary roots examined, but the structure and size varied with the species. *Q. alba* produced a large pith which extended for more than 40 cm. in a four-months'-old root, whereas *Q. palustris* produced a very small pith which did not extend beyond the first few cm. of the primary root.

6. The soil type had little direct effect on the anatomy or morphology of the primary root, although the roots grown on the lighter soil were less susceptible to root rot.

7. It was found that although the genus *Quercus* is tap rooted, very often due to environmental factors the tap root fails to develop and a lateral root system is formed.

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Growth of Pond Pine in a Pocosin Area[1]

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POND PINE (*Pinus serotina* [Michx.]) occurs from New Jersey to Florida and Alabama. The species can survive extremely wet conditions and because of prolific sprouting is seldom killed by fire (*1, 7, 8, 11*). On poorly drained frequently burned areas it occurs in pure stands. On better sites it is associated with longleaf, loblolly, or slash pine and in protected areas with swamp hardwoods or white-cedar (*3, 7, 12, 14*). In North Carolina the species has a type area of almost two million acres (*4, 5*).

The growth rate of pond pine has been considered to be slower than that of loblolly pine (*2, 8*). It grows faster than southern (Atlantic) white-cedar, especially in the seedling stage, and because of tolerance to fire is likely to succeed white-cedar (*10*). In the seedling stage the species can endure shade for many years (*1*).

This study was undertaken to gather specific information on the growth of pond pine in Hofmann Forest, located in Jones and Onslow Counties in the lower Coastal Plain of North Carolina. The dominant plant cover on the forest and the area immediately around it varies from longleaf pine on the drier ridges, loblolly pine on better sites, pond pine on the wetter, frequently burned areas, to an open shrub-bog in which tree growth is absent or limited to stunted pond pine not over 7 or 8 feet high. Pond pine makes up over 90 percent of the cover on the 79,000-acre forest. Sampling for this study was restricted to stands in the approximately 60,000 acres of commercially usable forest located peripherally around the brush-bog areas. In these areas surface water may be present during the major part of the growing season. The soils are predominantly of the Bladen, Portsmouth and Pocomoke series characterized by dark gray sandy loam surface soil and rather heavy subsoil for Bladen but more friable subsoil for the other two. Because of past fires the stands sampled were pure pond pine.

Sampling Procedure

The dense cover of brush and smilax (*Smilax* spp.) in the pond pine areas of Hofmann Forest makes progress through the timber extremely difficult and slow. For this reason sampling was confined to accessible areas near roads, trails, firelines and other developments.

Site differences were not considered at the time of sampling because no site index information was available for the species. Since then, however, a study of pond pine sites by Hofmann (*9*) has shown that the pond pine site index for Hofmann Forest varies from 40 to 60.

Each stand was examined for approximate age, logging history, and commercial operability. If the stand was found suitable, a baseline was established through it using roads and trails where possible. Then, starting at the edge of the stand, a distance of 5 chains was measured into the timber along the baseline. At this point a sampling line was extended 5 chains out at right angles to the baseline. Successive lines were established at 10-chain intervals along the baseline. Each line was in the opposite direction from the preceding one. The number of sampling lines from a given baseline varied with the area of the stand.

Five trees were sampled per sampling line, each the dominant pond pine nearest to the right at the end of every chain of distance. If the d.b.h. of the sample tree was less than 9.6 inches the tree was felled for measuring. Age and radial growth rate were determined from a section at breast height. For larger trees, age and growth were determined from 3 increment borings taken at intervals of 120 degrees around the bole at breast height. Height was measured with an Abney level. Form class data for saw timber, over 9.6 inches d.b.h., was obtained by climbing the tree.

A total of 318 trees were measured and grouped into 12 five-year age classes ranging from 6-10 to 61 years and over at breast height. The last class included trees to 102 years of age. After approximately 200 trees had been examined the standard error of radial growth for the last 10-year period was determined for the age class 11-15 years at b.h., since this class had the largest number of trees. The standard error, 0.13 inch, was assumed to be determined accurately enough to be used to estimate, by procedures outlined by Snedecor (*13*), the number of samples needed in the other age classes. Radial growth measurements were taken to the nearest 0.1 inch.

To find the total age of the trees, 30 trees on the areas sampled were cut off at the ground line. Ring counts at ground level and breast height showed an average age difference of 4 years. This number was added to all ages taken at breast height for the entire 318-tree sample.

Actually, 4 years of age to breast height is somewhat arbitrary. After a fire, young trees several feet or more high before being burned off at the ground line will, under favorable conditions, often have sprouts which reach breast height the first year. On the other hand, seedlings unaided by burning may require 12 or more years to reach breast height. Much of Hofmann Forest has been burned several times within the past 15 years and more frequently in prior times. It is a safe assumption that the majority of the trees used in

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TABLE 1.—SAMPLE SIZE BY 5-YEAR AGE CLASSES BASED ON AGE AT BREAST HEIGHT[1]

Age class (years)	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-plus
No. of trees	35	48	35	45	26	30	21	12	14	8	11	33[2]

[1]Addition of 4 years makes these classes 10-14, 15-19, 20-24, etc.
[2]Include trees 61 to 102 years old.

this study had not grown from seed without interruption. Some originated as rootcollar sprouts following fire-killing of the previous stem and others replaced leaders with epicormic branches.

Presentation of Data

The analyses for Figures 1-5 were made on the premise that age is the independent variable. The square of age was added to the regression equation as a second independent variable in order to represent the non-linear relationship. The sample sizes by age classes are presented in Table 1.

For height, 82.16 percent of total variation was attributable to age. In the case of diameter, the percentage was 80.99 percent. For rate of basal area increase, however, only 6.9 percent of the variation was ascribable to age. A 3 x 3 matrix calculation by the abbreviated Doolittle method (*6*) for height, diameter, and rate of basal area increase with age, stand density and previous diameter (d.b.h.) as the independent variables, showed that 37.95 percent of the variation of rate of basal area increase was attributable to these factors. For this calculation only 295 trees were used since 23 had less than ten years of growth at breast height. All the independent variables significantly influenced variations of each of the dependent variables but stand density was found to be least influential. Collectively they accounted for 83.46 percent of the variation in height and 93.81 percent of diameter. Stand density as used here was the number of trees 4.6 inches d.b.h. and larger on a 1/40th acre circular plot with the sample tree as the plot center. Density varied from no trees to as many as 15. In a few cases as many as five sawtimber trees were tallied.

In general, stocking on Hofmann Forest is low so that little competition exists. Hofmann (*9*) found that on mineral soil stand density of pond pine varied as the moisture equivalent. He omitted it as an independent variable in an investigation of factors affecting height growth.

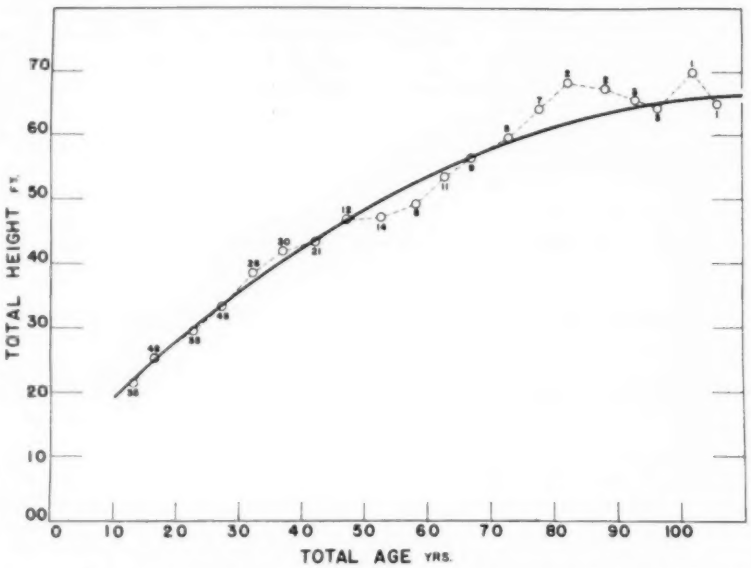

FIG. 1.—The regression of height on age for 318 pond pine trees from 10 to 106 years old[1] with the weighted averages when the trees are grouped into 5-year age classes.

[1]Height on age: 318 trees.
$\hat{Y} = 9.78$ feet $+ (1.000389)$ (age) $+ (-.004403)$ (age^2).
t values for regression coefficients b (age) and c (age^2) $= 16.53^{**}$ and 7.15^{**} respectively.
R^2 (100) $= 82.0$ percent.

Height growth was most rapid for the youngest age classes measured and dropped off steadily through the remaining age classes. The average height at 20 years was 28 feet, at 50 years 49 feet, and at 100 years 66 feet. Very probably part of the rapid juvenile growth rate was due to sprout vigor with sprouting usually brought on by fire. Less frequent burning since Hofmann Forest was brought under management probably permitted the present younger age classes to grow at a rather sustained, infrequently interrupted rate. The older age classes were subjected to more frequent defoliation and dieback as a result of fire during the periods when height growth normally would have been most rapid.

The more rapid rate of diameter increase for the younger age classes also is apparent, and in a measure at least, may be partially related to the effects of burning as height growth appears to be. At 20 years the average diameter was 5.8 inches, at 50 years 10.4 inches, and at 100 years 13.8 inches.

The rate of increase in basal area is considered here to be indicative of volume changes in the tree when length of the bole is disregarded. For the trees measured, the rate of basal area increase outside the bark was greatest, 0.187 square foot, for the 10-year period ending at 54 years of age. At 20 years of age the rate was 0.148 square foot per 10-year period and at 100 years of age it was 0.111 square foot.

In the interval from 40 to 65 years of age the rate was over 0.180 square foot per 10-year period.

Inside the bark the rate of basal area increase had a trend similar to that outside the bark. The peak rate, however, occurred at about 68 years of age instead of 54 years. The curves in Figure 3 indicate that as the age of the tree increased growth of wood was maintained at a better rate than bark growth.

The trend of the regression of double bark thickness is very similar to that of the rate of basal area increase. A double bark thickness of 2.19 inches at 62 years was the maximum average. At 20 years the average was 1.59 inches and at 100 years it was 1.71 inches. Variation in the ages from 51 to 75 years was from 1.5 inches to over 3 inches. A maximum double bark thickness of 3.6 inches was measured for two trees in the 31-40 year age classes. MacKinney (*11*) found that for second-growth longleaf pine protected from fire for an extended period, 59 percent of the variation in bark thickness was correlated with variation in diameter. Protected trees had the thickest bark, trees subjected to controlled burning annually for 4 years after prolonged protection had thinner bark, and trees burned accidently after 14 years of protection had the thinnest bark. In pond pine that is burned as frequently as in the pocosins of eastern North Carolina decrease in bark thickness would be expected as the trees approach maturity.

Trees with an average height of 49 feet at 50 years seldom produce a merchantable length of over 2 or 2½ logs. This is reflected in the rather low average form class for the 79 trees for which form class data were taken.

Discussion

The qualities of pond pine which enable it to resist killing by fire and to survive on wet sites have resulted in extensive, almost pure stands in the pocosins of North Carolina. Generally, these stands have only a low volume per acre, seldom over 5,000 bd. ft., and the trees often are of poor form and quality. Red heart infection may be frequent in some stands and almost absent in adjacent stands. Where severe burning has occurred frequently, reproduction and sapling sized trees may be almost entirely absent.

Experience on Hofmann Forest has shown that as the frequency of burning decreases reproduction becomes more abundant. Within the period of active management of the forest, since 1935, extensive stands of seedling and sapling size have become established. Where these stands occur on more favorable sites as regards soil moisture and are relatively undisturbed by fire, development of adequately stocked stands of good vigor and tree form

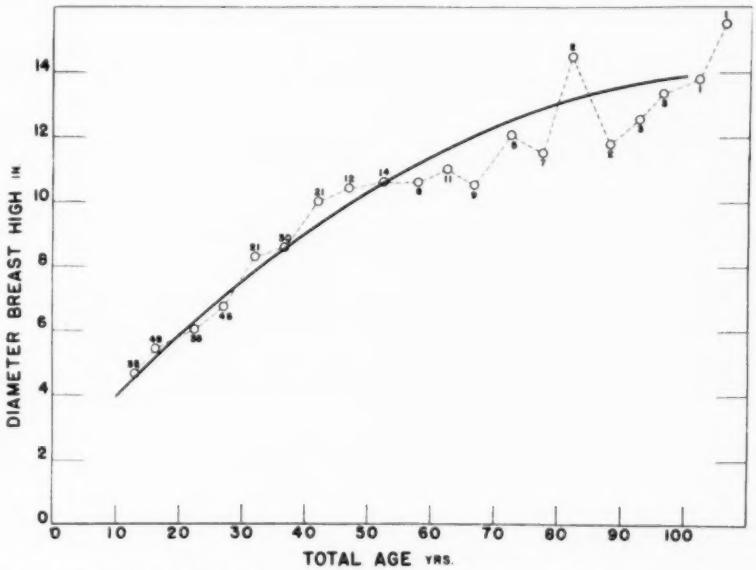

FIG. 2.—The regression of diameter breast high on age for 318 pond pine trees from 10 to 106 years old[1] with the weighted averages when the trees are grouped into 5-year age classes.

[1]D.b.h. on age: 318 trees.
$\hat{Y} = 1.815$ inches $+ (.221)$ (age) $+ (-.001)$ (age^2)
t for the regression coefficients b (age) and c (age^2) $= 16.92^{**}$ and 7.46^{**} respectively.
R^2 (100) $= 81.0$ percent.

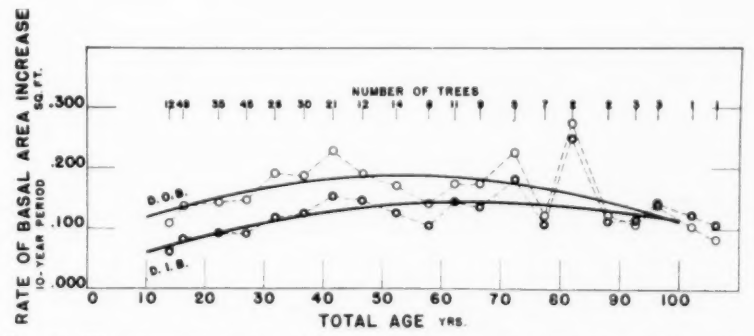

FIG. 3.—The regression of rate of basal area increase for a 10-year period on age for 295 pond pine trees 14 to 106 years old.[1] The upper curve is for outside the bark and the lower for inside the bark. Weighted averages are shown for the trees grouped into 5-year age classes.

[1]Double Bark Thickness on age: 295 trees. Twenty-three trees were too young to have 10 years' growth at breast height.
$\hat{Y} = .849$ inches $+ (.044078)$ (age) $+ (-.000344)$ (age^2)
t for the regression coefficients b (age) and c (age^2) $= 2.24^{*}$ and 18.03^{**} respectively.
R^2 (100) $= 20.0$ percent.

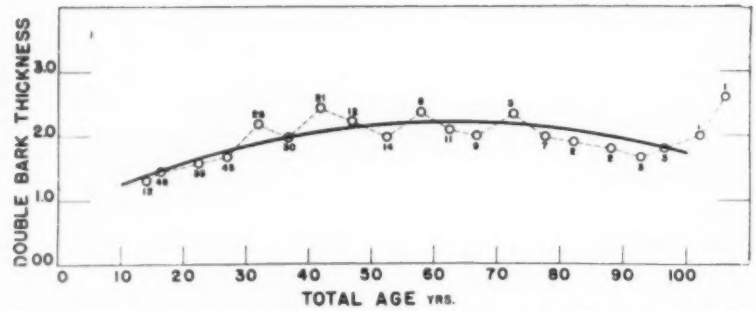

FIG. 4.—The regression of double bark thickness at breast height on age for 295 pond pine trees 14 to 106 years old[1] with the weighted averages when the trees are grouped into 5-year age classes.

[1]Outside the bark. Rate of Basal Area Increase on age: 295 trees.
$\hat{Y} = .078$ square feet + (.005934) (age) + (−.000058) (age^2).
t for the regression coefficient b (age) and c (age^2) = .73 and 7.07** respectively.
Inside the bark R^2. (100) = 6.9 percent.
$\hat{Y} = .030$ square feet + (.003402) (age) + (−.000028) (age^2).
t for the regression coefficients b (age) and c (age^2) = 5.97** and 4.33** respectively.
R^2 (100) = 18.9 percent.
Rate of basal area increase outside the bark is equal to the present basal area minus the basal area 10 years ago as calculated from the d.o.b. ten years ago. D.o.b. 10 years ago was found by first correcting, by addition or subtraction, for variation in double bark thickness in the 10 year interval as determined from the curve of double bark thickness on age and then subtracting twice the average thickness of the past 10 years' growth as determined from measurement of a cross section or by increment borings.

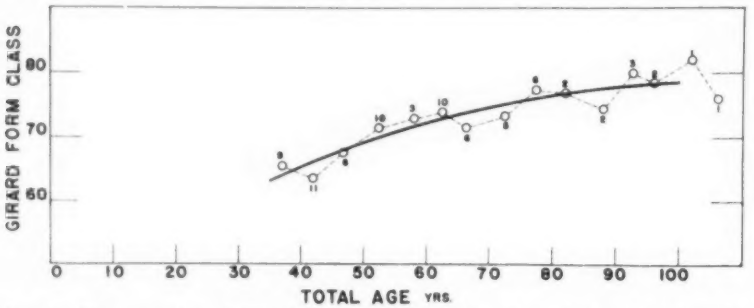

FIG. 5.—The regression of Girard form class on age for 79 pond pine trees from 36 to 106 years of age[1] with the weighted averages when the trees are grouped into 5-year age classes.

[1]Girard Form Class on Age: 79 trees. The other trees were smaller than sawtimber size.
$\hat{Y} = 43.5117$ percent + (.674010) (age) + (−.003233) (age^2).
t for the regression coefficients b (age) and c (age^2) = 2.15* and 1.06 respectively.
R^2 (100) = 35.9 percent.

can be expected. Present evidence indicates that some improvement in site can be obtained by suitable drainage. Conditions for timber harvesting can also be improved very much by proper ditching which will drain off surface water during periods of excessive rainfall. The spoil banks along drainage ditches provide roadbeds for forest operation.

The data indicate that pond pine stands such as these might best be managed for pulpwood and small sawlogs on a rotation of 50 to 60 years. As the deleterious effects of fire are eliminated there is reason to believe that the tree sizes and stand volumes expected at those ages will increase or that adjustment in rotation length can be made.

Summary

Data are presented on height, d.b.h., rate of basal area increase, double bark thickness, and Girard form class for 318 pond pine trees from 10 to 106 years old growing in Hofmann Forest, North Carolina.

The trees grew in soil saturated for extended periods during the growing season and were subjected to intermittent burning. Annual fires occurred over much of the area until 1935 when efforts at protection and management were started. For an average site index of 49 at 50 years the maximum average height was 66 feet at 100 years of age. The maximum average rate of basal area increase was 0.187 square foot for the 10-year period ending at 54 years of age. The trend of the rate indicates a natural rotation of about 60 years. At 60 years the average tree was 55 feet high, 11.5 inches d.b.h., with a form class of 73.

Under these conditions a rotation of 50 to 60 years for the production of pulpwood and small sawlogs is indicated. Through adequate fire protection and site improvement by drainage more favorable growth rates very probably can be obtained.

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Notes

Abstracts from an Address on Multiple Use of Forests[1]

The term "multiple use" was not common in earlier writings on forestry subjects. This is understandable, because at that time forestry ". . . aims to utilize the present product of the forest with the greatest possible economy, and with profit to the owner, and at the same time to provide for the continuance of the forest, and for the production of timber and other forest products in the future." All textbooks on forest management, beginning with Schlich's "Manual of Forestry", not only emphasized, but dealt exclusively with the management of the forest for wood production. The textbooks by Recknagel, Roth, and Matthews are outstanding in ignoring multiple use.

Chapman, in his discussion of "the place of forest management in forestry", does devote seven pages to "park and recreational use of forests", and in ten more pages discusses the "coordination of land use." However, the other 492 pages are devoted to wood production. Even the most recent textbook on forest management ignores multiple use. It does, however, define multiple use or multiple purpose use as "meaning a diversity of uses" which "may be applied to federal and many state forests . . ."

If silviculture is defined as the art of producing a forest for wood production, then the omission of silviculture practices required for forest uses other than for timber is excusable. It is only in the preface that Westveld suggests "that silviculture should be modified" if the other uses of the forest are a consideration. How they should be modified is not indicated there or in any other professional forestry textbook.

The only textbook generally used by forestry students that discusses very briefly some of the other uses of the forest—for wildlife and domestic animal production — is a book on forest protection which, of course, deals primarily with the detrimental effects of these uses to wood production. The second edition of Guise's book on the management of farm woodlands is the first textbook by a forester which discusses briefly the modifications in forest management practices that must be considered if wildlife production is one of the objectives of forest management. However, this book is seldom a text for professional forestry students.

The two major reasons why multiple use has thus far been neglected in the training of professional foresters rests on the shoulders of two organizations, the United States Forest Service and the Society of American Foresters. The U. S. Forest Service does not require such training as a prerequisite for employment on the national forests. The only uses, other than wood production, that are considered at all are wildlife and range management. The applicant for professional employment must offer one course in either, but not both. Even though the national forests had 30,000,000 recreational visitors last year, very few foresters have any basic training to assist in servicing these visitors.

The Accrediting Committee of the Society of American Foresters will accredit any forestry school as giving adequate forestry instructions even if that instruction is entirely in wood production. It will accept, but does not require, any training to assure that the graduate of the school is competent to practice multiple use forestry.

Despite these obstacles most forestry schools now, finally, either require or recommend as electives, courses in range, recreational and wildlife management. Water conservation is still generally ignored. Unfortunately, because of the many required courses in wood production, very few students are able to take advantage of all of the courses in other forest land uses, even when offered.

The difficult problem, of course, is to properly balance the several uses of the forest and apply such practices as will produce planned utility from each use. Foresters, because of their training, generally over-emphasize wood production and underestimate the value of the other forest uses. It is so simple to estimate the value of wood at so much a thousand board feet or per cord, and more difficult to evaluate a day's vacation in the forest. It is superficial and fallacious to reason that wood production produces wealth and the day's vacation does not, and to use this reasoning for neglecting multiple use in public forest management.

One of the most important problems confronting forest land economists and sociologists today is to determine equations whereby the relative importance of each forest land use can be established for each forest unit. Until some rational yardstick is established, the application of multiple use is not far removed from mythology.

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[1]Delivered at the annual meeting of the Michigan Academy of Science, Arts and Letters, Detroit, Mich., April 13, 1953.

South Carolina Sand Hills Can Grow Pine Timber

Over one-half million acres of South Carolina Sand Hills are considered by many to be a worthless timberland investment. Scrub oaks have dominated these lands for many years and as a result they have been locally named "Scrub Oak Lands."

History shows that sand hills were originally clothed with longleaf pine timber of high quality. Wholesale timber cuttings and land clearings at the turn of the century depleted most of the original timber. Settlers soon found that even though the land was easy to clear it did not retain fertility. Growing farm crops for subsistence became more difficult. Remaining scattered timber was chipped for turpentine, trees cut for lumber and stumps burned for pine tar. Annual wild fires completed the picture of destruction. They burned the small pine trees which were to form the next crop of timber and replaced them with worthless scrub oak sprouts.

The South Carolina State Commission of Forestry has found that successful reclamation of scrub oak lands can be accomplished at reasonable costs. The Sand Hills State Forest near Patrick, S. C., contains some of the poorest lands in the state, but slowly these poor sandy sites are being converted into pine plantations. The primary consideration has been found to be the dense mass of scrub oak roots which

FIG. 1.—Slash pine seedling planted in 1944 in untreated scrub oak area. Note that immediate top competition by scrub oaks is not too severe. Established scrub oak roots use the available ground moisture, and thereby prevent the seedling from growing. Photo taken July 1953.

greedily use the small amount of available ground moisture. Annual rainfall is 40 to 50 inches but in these deep sands, only a small amount of moisture is left for plant growth. Pine is at a great disadvantage if planted in scrub oak since it cannot successfully compete for this limited soil moisture (Fig. 1). If pine is given a few years' advantage to form a root system then the scrub oak is of little consequence because pine will dominate the scrub oak.

Advantage can be given to pine by drastically disturbing the scrub oak root system. Complete eradication is not necessary. The South Carolina State Commission of Forestry is using the following practice:

1. Reduce scrub oak cover during May or June by using a medium sized Marden Brush Cutter (Fig. 2).
2. Allow scrub oak to sprout.
3. Double plow area during July or August using an Athens firebreak plow (eight 26-inch discs). Plowing should be about 10 inches deep (Fig. 3).
4. Allow scrub oak to sprout.
5. Level area during September or October using a gang disc plow (sixteen 18-inch discs) (Fig. 4).
6. Plant area during December, January, or February using a machine planter.

A 40-horsepower crawler tractor is necessary power for both the brush cutter and firebreak plow. The gang disc plow and tree planter can be powered by a light farm tractor. The above schedule of treatments allows the scrub oak to sprout and be disturbed several times, thereby effecting better control. Over 800 acres have been cleared on the Sand Hills State Forest during the past 4 years. Average time required for clearing and plowing is shown in Table 1.

Costs for brush cutting and plowing on the state forest have averaged $9.61 per acre. This low figure, however, is due to low labor and equipment rental costs. Local operators indicate that commercial

FIG. 2.—Marden Duples Brush Cutter clearing a scrub oak area. Note that the scattered pines are also cut so as not to permit "wolf" trees.

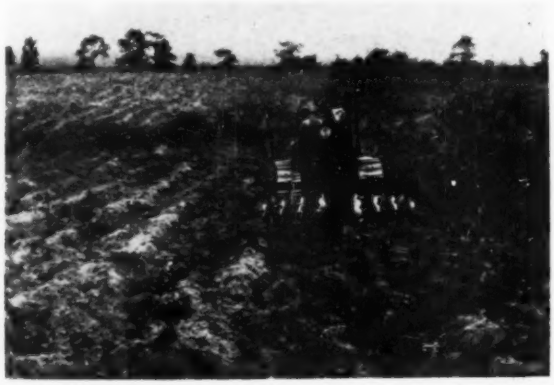

FIG. 3.—Athens plow double discing a brush cut area. Discing to a 10-inch depth destroys the network of scrub oak roots.

Fig. 4.—Scrub oak cleared by brush cutter, firebreak plow and gang-disc plow. After settling, area will be ready for planting.

Fig. 5.—Three-year-old slash pine plantation established on previous scrub oak site. Note dominance of pine over scrub oak sprouts.

costs would average about $25.00 per acre with $3.00 per hour supervision, $0.75 per hour labor and $9.00-$11.00 equipment rental.

Slash pine has been planted in all of the cleared areas because of easy establishment and rapid initial growth. Five-year-old test plantations average 80 percent survival and 7 feet in height. The scrub oak cover has not been eliminated in plantations but only reduced to a point where pine could successfully compete. It is no longer a problem in established plantations. Present indications are that pine will retain its dominance if growth continues as in the past (Fig. 5).

Plantations have not been established on scrub oak lands long enough to provide growth figures other than those above. However, 16-year-old plantations established on adjacent old fields where soil types are comparable yielded the information shown in Table 2.

The use of the brush cutter to eliminate scrub oak cover and the firebreak maintenance plow to tear up the scrub oak roots to about a 10-inch depth has proven to be sufficient treatment prior to planting pine. Indications are that expensive and heavy equipment may not be necessary in smaller sized scrub oak. Recent performances of the Harris Bush Hog "Brush Cutter," Ford tractor and the "Sieco" two-disc plow have shown great promise and, if they are successful, site preparation costs would be considerably lower.

Various treatments such as clearing scrub oak cover with a heavy cable swung between two crawler tractors, applying poison foliage sprays to scrub oak sprouts with power equipment to eliminate plowing, and other such similar treatments are being constantly tried on the Sand Hills State Forest so that the most effective and economical method of reclaiming scrub oak lands can be devised for local use.

Table 1.—Time Per Acre for Brush Cutting and Plowing

Item	Brush cutting	Plowing	Total
		Hours	
Supervision	1.10	0.78	1.88
Labor	4.98	3.77	8.75
Equipment rental	0.62	0.71	1.33

Table 2.—Performance of Slash Pine on Old Fields[1]

		Per acre
Trees 4 inches d.b.h. and larger	number	866
Merchantable volume	cords	32
Basal area	square feet	127
Average d.b.h.	inches	5.2
Trees below 4 inches d.b.h.	number	144

[1]Planted 1,210 trees to the acre in 1937, measured in 1953.

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S. C. State Commission of Forestry, Columbia

Correction

The name of T. S. Coile as consulting forester and soil scientist was listed in error in the Consulting Foresters listing for January 1, 1954, Jour. Forestry 52: pages 61 and 69. Mr. Coile was not a member of the Society of American Foresters, which is a requirement for such listing.

The Forest Service of the Republic of Turkey[1]

The Turkish Forest Service seems to have served, at least in part, as the pattern used in the establishment of the United States Forest Service, now about half as old as that of Turkey. The organization is headed by a Chief Forester, assisted by one or two assistant chiefs. His office is divided into many more divisions than that of the United States.

These include the divisions of:

1. Fire, disease and insect control, and wildlife management.
2. Land classification and acquisition.
3. Forest management.
4. Forest products and sales.
5. Range management and administration of private forests.
6. Information and education.
7. Research.
8. Engineering.
9. Nurseries and reforestation.
10. Mining permits.
11. Forest statistics and foreign relations.
12. Fiscal control of exploitations.
13. Inspection.

In addition to the divisions of the chief's office, separate groups of offices report directly to the chief. These include a technical staff, personnel management and operation personnel, a legal advisory group, and a group handling fiscal control of federal spending.

The Turkish Forest Service has supervision of timber cutting on privately owned lands as well as on lands owned by the federal government. Within the forested areas, approximately 95 percent of the land is owned by the government. The entire area of the republic is divided into 15 regions, each in charge of a regional forester. He is assisted by an assistant regional forester, serving as an administrative officer. In addition, divisions similar to those of the chief's office are established in regional offices as required, each in charge of a division chief.

The regions are divided into national forest exploitations (not known as national forests) each in charge of a forest supervisor, totalling 85, or usually 5 or 6 to a region. In turn, each forest exploitation has from 8 to 10 ranger districts, each in charge of a district ranger. The regional foresters, supervisors, and district rangers are all technically trained foresters, and graduates of the Forestry Faculty of the University of Istanbul. The district rangers are assisted by from 1 to 3 assistant rangers. Most of these men are graduates of the Forest High Schools formerly existing in Bolu and Bursa. The personnel includes over a thousand.

The total forest area of Turkey is about 25,000,000 acres. This is approximately 13 percent of the total area of the country. The usual area of a region is about 1,600,000 acres and average area of a forest exploitation is about 300,000 acres.

In general, forest practices are much more intensive than in the United States, and supervision is also extended to privately owned lands. On areas being cut over, utilization, except in isolated regions, is usually to 4" in the tops and use of by-products is very common. After timber is marked for cutting, local officers enter into a contract or agreement with a company or with local peasants for felling, skidding, and hauling the timber from the forest to a selling location outside the forest. Here the timber is sold under open or closed bidding. No cutting or hauling of timber is permitted except under this arrangement.

The distribution of forests in Turkey is closely related to the presence of rather high humidity. Most forests are located in the mountains paralleling the Black Sea in the north, and the Mediterranean in the south. Other areas in the west are east of the Aegean Sea. Other forests surround the Marmora Sea and also exist under favorable climatical conditions in the eastern portion of the country. The central part of Turkey is a high plateau which has never supported a forest cover.

The important timber species include pines (*Pinus nigra, silvestris, brutia,* and *pinea*), firs (*Abies nordmanniana* and *equi trojani*), spruce (*Picea orientalis*), cedar (*Cedrus libani*), several junipers, beech (*Fagus orientalis*), several oaks, and other broadleaf species.

The majority of forest areas are in poor condition, because of being cutover for the past several centuries to meet the demands of local residents. The aim of the Turkish Forest Service is to preserve the conditions existing in those forests which are in satisfactory condition, and to improve those areas not in good condition, through effective management and protection.

As a result, it is necessary to import considerable forest products from other countries. A minor amount of timber is exported, consisting of products in special demand, such as Cedrus to Syria and Palestine, and dry kilned beech to all Arabic countries.

In the lumbering operations, it is not permissible to mark any timber for cutting unless a management plan has been prepared for the area. The service has 15 management crews in the field each year preparing management plans over different areas in the republic. The Forest Service does the field and office work for the preparation of all maps, and recently has initiated the use of aerial photographs in the making of maps.

The forest exploitations are well organized for fire protection and for fighting fires. Lookouts have been constructed covering all areas. These are equipped with telephones connecting to a good system furnishing satisfactory service. It is anticipated that radios will shortly be used on the lookouts.

Reforestation is one of the important programs of the service. A number of nurseries are in opera-

[1]The material for this article was obtained during conversations with the interpreters (all foresters) in the group of 18 Turkish foresters who visited the National Forests of the Rocky Mountain region during 1953. These men visited this country under the auspices of the Foreign Agricultural Service of the Department of Agriculture and the Foreign Operations Administration with the Forest Service serving as technical adviser.

tion and each year extensive plantations are made near the villages for farm woodlands. In addition, planting is done in unstocked areas in the forest exploitations. Thinning and pruning of areas in the forest exploitations is also undertaken to improve the stands for the production of a better class of forest products.

The building of roads in forest exploitations is also the responsibility of the Forest Service. Those roads are, of course, used in the hauling of timber products, and as access roads in fire fighting.

Research work in Turkey has only recently been initiated and many fields are to be covered as this work is expanded.

The republic has a very good forestry school at the University of Istanbul. It is located in a training and experimental forest, has good laboratories, and an extensive plant with excellent buildings. The school gives a four-year course covering all usual phases of forest education and grants a degree comparable to a B.S. in forestry.

Salaries paid Turkish foresters vary a great deal and rangers may sometimes receive as much as a forest supervisor on the basis of seniority. In general, rangers are paid from 200 to 400 Turkish lira per month; supervisors 300 to 500 lira per month; and regional foresters 400 to 1000 lira per month. At the present exchange rate, $1.00 U. S. money equals 2.8 in Turkish money. The value of money in Turkey, however, in buying power has a value of 3 or more to one, rather than as shown by the exchange rate.

The position of men of the Turkish Forest Service is unique in that they may run for political office. They may take leave and run for office and, whether defeated or not, may later return to the service. Exceptions to this are the chief and head of the technical staff, who must retire 45 days in advance of election day. This decision is based on the assumption that these men have direct influence on the people and should not return to the organization.

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Santa Cruz, Calif.

[2]Retired assistant regional forester, Rocky Mountain Region. Mr. Hilton served as consultant and trip manager for the group of Turkish foresters.

Mettler's Woods

Mettler's Woods is a tract of 65 acres containing a primeval forest of oak, hickory and beech trees, probably Type No. 52 (White Oak — Red Oak — Hickory) under the new classification, and surrounded by 71 acres of protective field. It is located near East Millstone in Somerset County, New Jersey, on road number 514, seven miles west of New Brunswick and six miles south of Somerville.

It is believed to be the only remaining climax stand of hardwood on the Eastern seaboard. The woods is a natural monument of great antiquity, zealously preserved by the owners since 1690. Handed down from generation to generation as a family tradition, it has survived as a self-perpetuating, uncut, and undisturbed group of great oaks, hickories, and beeches.

Annual rings of some of the trees blown over in 1950 show them to be up to 310 years old, having started to grow about 50 years before white men settled the area. The topsoil in the woods is up to three feet deep, and shows no sign that a plow has ever disturbed it.

The woods is thus a living monument to the past, an historial museum and a natural laboratory. This is what the explorers found in New Jersey, and what the first settlers cleared. It is therefore, of continuing interest and value to the American people.

Scientifically it has additional values. It represents a climax community of plants that should remain relatively unchanged as time passes. It contrasts sharply with ordinary forests on the seaboard that were once cut over and now show relatively rapid biological changes leading towards stability. To understand those changes which occur in nature and the climax toward which younger areas are evolving, such a tract as Mettler's Woods is a prerequisite. And to learn fully about practical hardwood forestry, a climax stand is required as a reference point.

The present owner is forced to dispose of the 65 acres of trees as well as the 71 acres of protective surrounding field. An offer of $85,000 has been made for the tract but the owner prefers to have the woods preserved, if at all possible, and will accept $75,000. A Citizens Committee for the Preservation of Mettler's Woods has been organized to raise the funds and to give the woods to Rutgers University from whom assurance have been received that the tract will be preserved and maintained in perpetuity.

This historical natural laboratory can only be preserved through the voluntary financial support of citizens who appreciate the importance of saving these woods.

The Committee on Natural Areas has supported this drive to preserve an invaluable Natural Area for future Americans. We now appeal to all foresters to join this voluntary effort.

John F. Shanklin,
Chairman, Committee on Natural Areas

Comments on "White Hollow Watershed Management"[1]

Rothacher's article on the "White Hollow Watershed Management" study presents an interesting picture of the hydrologic and vegetative changes brought about by 15 years of protection and reforestation on a 1,715-acre watershed. Such pilot studies as this are a most effective means of demonstrating the value of practical watershed management.

It seemed to me, however, that the casual reader—and particularly those who may have read only the abstract and the summary—might infer incorrect conclusions from the article. To those readers who may already be somewhat confused by the controversy over the effect of vegetation on streamflow, the article may even tend to add further confusion. It is with these things in mind that I offer the following comments.

The theme of the paper is set in the abstract which reads, in part, "Fifteen years of protection and reforestation have so improved the forest cover of 1,715-acre White Hollow watershed in eastern Tennessee that the summer peak flows have been reduced 73 to 92 percent; the duration of summer storm runoff has been prolonged 500 percent. A more sustained flow has resulted without any material change in total water yield." The article points out that "The decrease in peak runoff during the summer season is the most marked result of improved forest cover." But by careful reading, it appears that "forest cover" may have had little to do with the runoff changes. In the author's words, "All data on maximum height of streamflow indicate that by far the greatest change occurred immediately after cultivation stopped and adequate protection from fire and grazing began." Quoting from the cited reference[2] ". . . the most rapid changes in the character of the runoff occurred during the first several years following 1935 and 1936 when only the processes of natural revegetation were operating." It would seem from these two citations that the peak reductions reported were due largely to the increase in ground cover which followed naturally after grazing and cultivation were stopped rather than to improved "forest cover." Reforestation and fire protection probably would have had little effect on the early streamflow changes. There is another factor which, it seems to me, might have had an effect on peak discharges. That is the engineering work done in 1934-1935. Presumably these measures were installed on areas of high surface runoff. It might have taken a few years for them to stabilize the soil, hence to exert their maximum effectiveness. Isn't it conceivable that the period when their effects on streamflow may have begun to show up, coincided with "the first several years following 1935 and 1936"? This possibility is not suggested in the article.

Although storm runoff patterns showed marked changes, there was no significant change in total water yield during the 15 years. As Rothacher points out, increased interception and transpiration losses which would be expected from increased cover density were either insufficient to be recorded in streamflow changes, or were balanced by other factors such as reduced evaporation losses. The change in stream regimen is rightly attributed, then, to changes in the runoff pattern from flow to subsurface flow rather than to any change in the amount of water which eventually emerged as streamflow. Changes in peak flows were much greater for summer periods than for winter periods. This is an interesting observation inasmuch as transpiration and interception are assumed to be unimportant factors in the study. The most logical explanation for the difference would be that winter rainstorms were of less intensity, hence infiltration was less limiting during winter storms. Another reason might be that the dormant winter vegetation offered less protection to the soil than the growing summer vegetation.

The hydrologic changes that are reported were detected by comparing streamflow hydrographs from similar storms and antecedent conditions over the period of study. Streamflow measurements were made on just one stream, White Creek. Records from this stream alone form the basic streamflow data used in the analysis. Yet it is pointed out that the streamflow records were obtained from 1934 to 1948 from a weir which "did not give the sensitivity required to record streamflow changes during the years." A new weir was installed in 1948. Comparison of flows before 1948 is made from records which are admittedly of questioned accuracy. Comparison of flows before 1948 with flows after 1948 is made by comparing hydrographs from different weirs. Changing the measuring device during the study injects additional sources of error into the analysis, and tends to suggest further that the accuracy of the results might be questioned.

This case history has yielded information which will be useful to both scientists and land managers in substantiating claims in behalf of their water management activities. It should also stimulate others to undertake similar projects which would add further information to our knowledge of watershed behavior throughout the country.

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[1]Rothacher, Jack S. White Hollow watershed management: fifteen years of progress in character of forest, runoff, and streamflow. Jour. Forestry 51:731-738. 1953.

[2]Water Control Planning Div., T.V.A. Effect of 15 years of forest cover improvement upon hydrologic characteristics of White Hollow watershed. Rept. No. O-5163. T.V.A. Page 21. 1951.

Using the Climbing Rope and Saddle in Forestry

The climbing rope and saddle (tools of the tree surgeon) have several useful applications in forestry. They make tree-climbing jobs both easier and safer. The equipment is simple. It consists of 75 to 150 feet of ½-inch manila rope and the "saddle" or safety belt. The saddle is made up of ½-inch rope and heavy leather belting (Fig. 1).

The climbing rope and saddle will not get the climber up the tree. He must use the "Tarzan" method. This is not as difficult as it sounds, but it does take training and experience. Let's follow a good climber step by step as he uses this equipment.

After getting into the saddle, the climber hooks one end of his climbing rope to his belt. The tree selected has small, dead lower branches, and looks like a tough tree to climb. The climber reaches up and gets a grip on a couple of the strongest lower limbs. He doesn't shinny—instead he goes right up the tree as if the limbs were ladder rungs. We notice that he turns his rubber-soled shoes sideways so that the sole of his shoe is flat against the trunk and the edge of the sole is in a limb crotch. This climber's trick keeps his weight on the enlarged base of the limb. Another secret of safe climbing he uses is to divide his weight between at least two holds. This cuts down the strain on individual limbs, so that even some rotten limbs will hold the climber's weight. Rotten limbs are treacherous, however, and a climber learns to test each one before he trusts his weight on it. Sometimes (on clear-boled trees), the climber may need to use climbing spurs to reach limbs strong enough to support his weight.

When our climber is up as high as he wants to go, he hooks his elbow around the tree and begins rigging up. First, he loosens the end of the rope from his belt, passes it *around* the trunk over a whorl of branches, and pulls the end through the eye splices of his saddle. Next, he ties a bowline around the eye splices, drawing it up snug, and leaving a three foot tag-end. He ties the tag-end around the rope-to-the-ground in a modified taut-line hitch (Fig. 2). The climber must tie this knot exactly right—his safety depends on it. Then he is ready to put his weight on the rope (Fig. 3).

When he wants to go down he pulls down on the top of the hitch with his left hand while letting the rope slide through his right. He controls the

Fig. 1.—The climbing saddle. On the top is the belt. The leg straps are at the lower left and right. The rope is 12-14 feet long with thimble protected eye splices at each end. The knots are bowlines. Copper rivets and leather strips are used in connecting the rope to heavy leather belting. Snap hooks at each end of the belt hold tools.

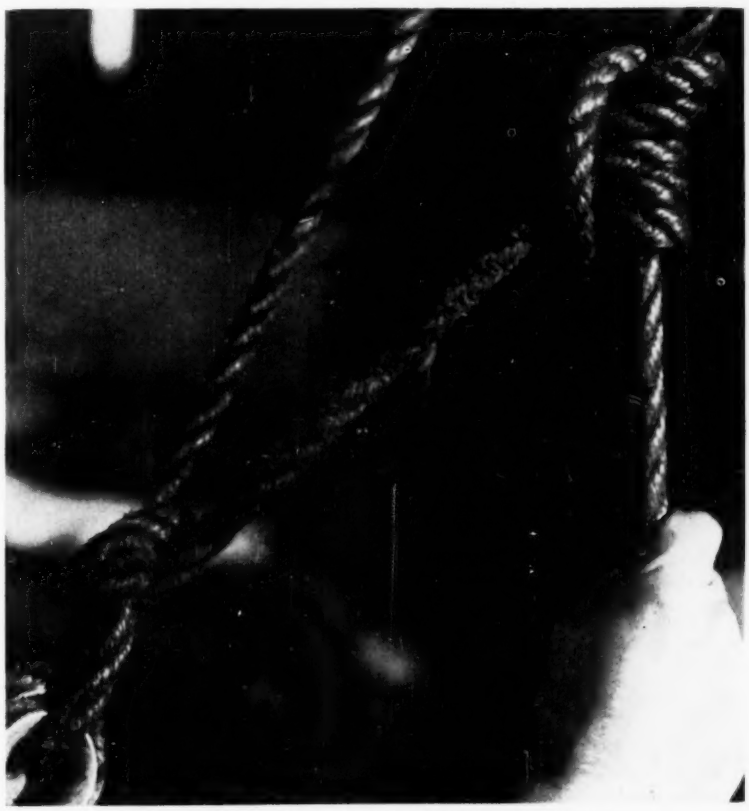

Fig. 2.—The all-important bowline and modified tautline hitch knots.

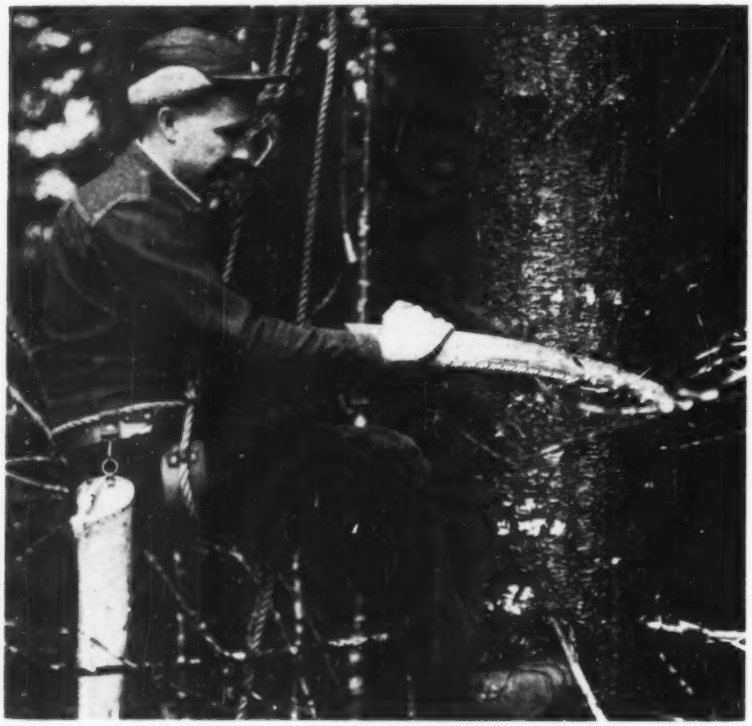

FIG. 3.—The rigging used for high pruning. The taut-line hitch is directly over the climber's head.

speed and distance he drops by gripping the rope with his right hand. When he wants to stop he lets go of the hitch with his left hand, and the hitch tightens and stops his descent.

If the climber wants to raise himself, he leans back and pulls down on the rope with both hands. This raises him about a foot. He slides the knot up the rope to hold the slack and repeats these actions until he is high enough. This is slow and not practical for more than a few feet. After the climber has lowered himself to the ground, he unties the knots and pulls down the rope.

The climber can maneuver himself to any position in the crown by pushing and kicking with his feet while keeping most of his weight in the saddle. This maneuverability is quite useful in cone picking. Every branch tip can be reached safely and stripped of its cones, a distinct advantage when cones are being picked from "elite" seed trees. This method is used at the Wind River Experimental Forest, Carson, Washington.

KENNETH R. EVERSOLE
Pacific Northwest Forest and Range Experiment Station.

Comments on "Calculator Interpolations"

In his derivation of a convenient method of making interpolations with the aid of a calculator Staebler (Jour. Forestry 50: 394) has overlooked a modification that reduces not only the work involved but also the chances of error.

For a two-way linear interpolation, a simplification of Staebler's equation reduces the number of products which must be computed from 7 to 4 and avoids the necessity of subtraction. Staebler's equation:

$i = a(1 + xy) + bx + cy + dxy - a(x + y) - bxy - cxy$, may be written: $i = a(1-x)(1-y) + bx(1-y) + cy(1-x) + dxy$.
Applying the modified equation to Staebler's example, $i = 331(0.2)0.6 + 370(0.8)0.6 + 367(0.4)0.2 + 410(0.8)0.4 = 331(0.12) + 370(0.48) + 367(0.08) + 410(0.32) = 377.88$.

The desired answer is now the arithmetic sum of 4 products instead of the algebraic sum of 7 products. Chances of error are reduced in proportion to the number of products (by 3/7) and in addition possible confusion is avoided between cumulative and negative multiplication.

The work form appropriate to the modified method is:

In symbols:		*Numerically:*	
Keyboard	*Multiplier*	*Keyboard*	*Multiplier*
a	$(1 - x)(1 - y)$	331	0.12
b	$x(1 - y)$	370	.48
c	$y(1 - x)$	367	.08
d	xy	410	.32

Accumulate products for interpolated value, i. $i = 377.88$.

JOHN W. KER
Assistant Professor,
University of British Columbia, Vancouver.

Reviews

Conservation Law and Administration

By William F. Schulz, Jr. 607 pp. Ronald Press Company, New York. 1953. $10.

For many years the importance to a practicing forester of a knowledge of laws relating to forest property has been emphasized in professional meetings. One great difficulty in becoming informed on this subject, however, has been the inaccessibility of concrete information on forest laws. This book is a step towards the answer to this problem, and should serve as a useful source of comparative information to foresters in Pennsylvania and in other states as well, for similar problems in conservation exist in practically all parts of the country.

The coverage of conservation laws in Pennsylvania and of their public administration represents an exhaustive study. Much valuable information is contained in this book that is not available elsewhere. Reading it for general educational value is worth the time of any forester.

To secure information on specific problems, however, the index could have been made more complete. For while it is possible to find information on almost all important items of interest to a practicing forester, there is some difficulty encountered in digging some of these out of the index, because, evidently to save space, a number of items have been included under one general reference name. For example, to find the discussion of fire protection regulations, one must look under "Fire Wardens" which is the only heading on fire in the index.

One major weakness of the book, in the reviewer's opinion, lies in the discussion of the Pennsylvania forest research program wherein only work done by the Department of Forests and Waters is mentioned although it is often exceeded by other agencies.

Another weakness, a minor one considering the general scope of the book, is the several inaccuracies encountered when some of the conservation topics are taken down to the ultimate details. Most of these are minor in nature, such as the failure to include graduate work in poultry husbandry as part of the Cooperative Wildlife Research Unit. But as a whole, the forest conservation concept is well done for a writer who is not a professional forester. Certainly, the legal aspects of the conservation field are most ably handled.

After describing in detail and discussing the various laws relating to game, fish, water, forestry, soil, and recreation and their administration, a model act for conservation administration is proposed in the form of a "statute." Important features of this statute include the incorporation in a Department of Conservation of all natural resources including mines and minerals. The head of this proposed department would be a Secretary, appointed by the Governor and Senate; a merit system is proposed only for all employees of lesser rank below deputy secretaries and division chiefs. This may be better than no merit system at all, but still leaves much to be desired for effective operation.

WILLIAM C. BRAMBLE

Woodworking for the Home Craftsman

By Emanuele Stieri. 376 pp. Illus. Barnes and Noble, Inc., New York. 1953. $1.50.

Distinctly, this is not a treatise for the skilled home craftsman. But, it is a good book for the lay woodworker and an excellent compendium and guide for the novice who is contemplating the fun of working with wood as a home hobby.

This is one of the publisher's creditable Everyday Handbook Series. Despite the fact that the subject matter coverage is good, the limitations imposed by the size of the book have prevented the adequate treatment of individual subjects.

The book successively discusses wood and its properties, hand tools, power tools, paints and finishes, home repairs and woodworking projects. Considerable attention is given to the selection, use, and care of tools. In particular, sound advice is given concerning the purchase of equipment for the home shop.

This reviewer strongly takes issue with the limited space and poorly developed portions of the text devoted to glues and glueing and to the finishing of wood. These are items of prime import to the average home woodworker and their slighting is hardly warranted. In contrast to this, the chapter on woodworking repairs has been practically designed and well done. It should be of great utility to almost any reader.

The illustrations are profuse in number, good in quality, and they provide effective supplements to the text. In many cases the pictures and diagrams carry the message ably by themselves. If you are not an experienced woodworker, here is a handy book to have around the house.

PAUL R. KRAMER

Timber: Its Structure and Properties

By H. E. Desch. 350 pp. Illus. St. Martin's Press, New York 17, N. Y. 1953. $6.

This British book in its revised third edition, is made up of four major parts:

"The Structure of Wood." The section consists of three chapters covering the classifications of trees, nomenclature, micro-structure in

general, and a detailed treatment of softwood and hardwood tissues.

"The Gross Features of Wood." The two chapters discuss such physical features as sapwood, heartwood, growth rings, compression wood, grain, figure, color, odor, etc. The general problem of identifying a piece of wood is discussed, and systematic methods of identification such as the use of a "key" are brought out.

Of particular interest is a discussion and illustration of a patented punched card "multiple entry key" identification system. Certain properties are listed around the card periphery with a card being provided for each species. A needle is run through a certain hole covering a specific property. Cards having the selected property drop out and are further processed in a similar manner until one or perhaps three cards remain, from which final identification is made. Advantages are said to be that (1) new or additional species can easily be added, and (2) any identification sequence can be used that promises speedy identification.

"The Properties of Wood." There are four chapters covering such items as density, strength properties, methods of testing for strength, effect of defects and moisture content on strength, stress grading, heat conductivity, and acoustical properties. No actual listing of strength properties by species is given.

"Considerations Influencing the Utilization of Wood." The eight chapters cover a wide range of subjects including seasoning, defects, decay, sap stain, worms in timber, wood preservation, timber grading, timber connectors, and wood adhesives.

Since this book covers wood from the tree through utilization, it necessarily does not treat any one subject in much detail. In effect, it presents the broad overall basic knowledge and principles in language which is easily followed by student or lumberman. The 65 photographic plates and 46 illustrating figures are good, and in many cases illustrate basic points in a very practical manner.

A list of botanical names for common or trade names is found in the appendix. This would be particularly valuable to people interested in European, tropical, and British species.

Naturally, being a British text, the book would in general be of limited appeal to the average professional forester or wood utilization man in the United States. Exceptions may be those particularly interested in the export trade to Europe or to other countries or colonies which are influenced by British trade practices and technical methods. For example, there is presented a discussion of grading practices for the Baltic trade and the Empire trade; British stress-grading rules are also discussed. The book is of value as a library reference for schools and laboratories.

ROBERT B. BLUMENSTEIN

The University of the South Forest

Forestry Department, The University of the South; Division of Forestry, Tennessee Department of Conservation; Division of Forestry Relations, T.V.A., 1953. Price on request.

This publication is both the story of a forest area and a management plan, together typifying much of the history of forestry in this country.

The story begins back in 1857 when a tract of 8,220 acres in southern Tennessee was chosen for an institution of higher learning that became the University of the South at Sewanee. The forest suffered the vicissitudes of unrestricted cutting and fires characteristic of the times, but survived as a unit. At the turn of the century it was one of the areas intensively studied by the Bureau of Forestry, rejuvenated under the leadership of Gifford Pinchot. Opportunities for profitable lumbering were good and application of good forestry practice seemed just around the corner. But, as revealed by hindsight, the corner was still far ahead. While some conservative lumbering and reduction of fires followed the Bureau's study and plan, the time just was not ripe for continued forestry and a long period of periodic fires, grazing, trespass, and indiscriminate cutting followed.

Beginning with the CCC days, fire control was tightened and better control of trespass and grazing established. In 1952, a reinventory of 6,851 acres of the original area was made, giving the basis for a rather complete management plan. Joining the rising tide of forestry in the country, it seems that management for sustained production has now come to Sewanee to stay.

The plan itself is noteworthy in several respects. To begin with, the report is very nicely put together; well organized, clearly and concisely presented and enhanced by some nice pictures. It makes good reading and a semi-layman can get a grasp of what a management plan is about. Management objectives and policies are specifically stated. A quality inventory was made, growing stock being classified as good, average or poor from the standpoint of future growth possibilities. Trees were also classed by four grades on the basis of their estimated quality lumber content. These classifications are carried all through the inventory summaries.

A feature of the plan is that it is accompanied by a complete system of records, both physical and financial. This includes 11 compartment inventory and record forms, a thorough financial system with 49 account and report headings outlined, and some forms for collection of labor and machine cost determination. A great deal of time and effort obviously was expended in working out the financial system which certainly will give complete financial information. It looks good, but I would like to see the system in operation after ten years to judge its effectiveness.

The immediate purpose of the plan is to guide a 10-year program of rather heavy improvement cutting aimed chiefly at removing defective, overmature, and poor-quality trees. A long range forecast is also made estimating dec-

adal cuts and defining major management objectives for 40 years. At the end of this period it is believed that the forest can be brought to reasonably full sustained yield productivity, yielding about 2 million feet a year from the 6,851 acres.

Much remains to be learned about handling the complex cove and plateau hardwood stands of the area and the long build-up period is necessary to overcome years of neglect. Many silvicultural and other decisions will have to be passed on to the future. This situation is characteristic of establishing forestry in an area. Successful management does not come all at once—it evolves.

Kenneth P. Davis

The Biltmore Immortals

Edited by C. A. Schenck. 342 pp. Illus. L. C. Wittich, Darmstadt, Germany. 1953. $10.

In the preface by Dr. C. A. Schenck, director of the Biltmore Forest School during the period of its existence from 1898 to 1914, he explains that this is the first volume of biographies of Biltmore alumni. A second volume is to come.

The present book contains the biographies of fifty alumni. Some are mere sketches; others are as long as forty pages. In all they make a colorful record of a group of Americans who were among the first to become interested in forestry as a profession.

A number of these early graduates subsequently dropped out of forestry work. But whatever their vocations, all seem to have enjoyed relatively successful careers and happy lives.

Biltmore produced some eminent foresters who during their careers notably helped advance the profession. Among those whose biographies are included in this volume are Swift Berry, lumberman; George H. Cecil, conservationist; Joseph S. Illick, educator; H. R. Krinbill, forest valuation engineer; D. E. Lauderburn, soil conservationist; Charles O. Marston, industrial forester; William J. Mills, consulting forester; Robert M. Ross, soil conservationist; A. C. Silvius, industrial forester; and George H. Wirt, state forester.

In listing the foregoing names, this reviewer is not singling them out for special attention as being greater than others, but simply to indicate the diversity of forestry activities in which Biltmore graduates practiced their profession.

Although this book is understandably of interest mainly to Biltmore alumni, it will provide fascinating reading for anyone desiring to know what manner of men these early American foresters were.

Henry Clepper

Incredible Seney

By Lewis C. Reimann. 190 pp. Illus. Northwoods Publishers, Ann Arbor, Mich. 1953. $3.95.

Among the numerous towns which came into being in Michigan during the days when the state's great pine forests were being cut, the one whose reputation for lawlessness and bawdyness so far outranked the others that it is still being discussed by old timers, is a little place in the Upper Peninsula called Seney. Located in Schoolcraft County on the Duluth, South Shore & Atlantic Railroad, and bordered by the forests and swamps of the upper Manistique River, Seney reached its heydey as a riproaring, wide-open lumbering town during the 80's and 90's of the past century with a population of about 3,000 broad-minded residents. This number was doubled at regular intervals when the lumberjacks came in from the camps or drives to celebrate and "blow in their stake."

Even in its quieter moments it became a place of hell-raising when the hordes of woodsmen descended upon it looking for whiskey, women, and gambling. Catering to these desires were twenty-one saloons, several blind pigs, and five brothels, all of which remained open twenty-hour hours a day when the "busy" season was on.

Its reputation became such that it is said that any station agent would sell you a ticket to Seney if you simply asked for a ticket to Hell. I can bear witness to this statement because I tried it as late as in the 1920's in several small towns of the Lower Peninsula.

Mr. Reimann's book is anecdotal in nature; that is, each chapter is more or less complete in itself. His descriptions of life in the logging camps of that period are excellent and preserve for us names and terms now almost forgotten. His chapter "Preparing for Supper" vividly brings back the days when the cook was king of the cook camp and strictly enforced the law, "no talking at the table."

That the author must have done a great amount of research is evidenced by the complete biographies and descriptions of the checkered careers of some of the famous and infamous characters who made Seney their headquarters. Outstanding among them is "Silver Jack" Driscoll who out-fought and out-drank all comers who challenged him. Among others who appear are John Dugan, a camp bully who was beaten almost senseless in a two-hour fight with Tim Kaine; Dan Dunn, Steve Harcourt, Angus Bronson, and many others.

Lewis Reimann's story of this fabulous lumber town is a distinct contribution to the history of lumbering in Michigan and is extremely interesting reading. His application of the term "incredible" is well taken, and will be appreciated by all who today drive through or stop in the peaceful little town.

Helmuth Bay

Wildlife Management: Fur Bearers, Waterfowl, and Fish.

By Reuben E. Trippensee. Vol. II. 572 pp. Illus. McGraw-Hill Book Co., Inc., New York. 1953. $7.50.

We now have Dr. Trippensee's second volume of *Wildlife Management*. The first volume was reviewed in the Journal of For-

ESTRY, Vol. 47, No. 1, January, 1949.

The general plan of this volume is similar to that followed in the previous one. The initial chapters under the general heading "The Foundations of Wildlife Production" are "Water and Its Conservation" and "Marsh and Swamp Management." These two are quite general in nature and probably should be studied with the initial chapters in the first three sections of the previous book. These are foundation material which the student should grasp if the subjects to follow are to be more easily understood. The other three sections of the present work are concerned with fur bearers, waterfowl, and fish, respectively. The present work has many points of superiority over the previous one, in the opinion of this reviewer. The material included throughout is as nearly current as possible in a work of this kind. The whole book is remarkably free from the minor errors which so often haunt an author. This is especially important in a book which is liable to be used as a text and hence studied word by word. The few errors that were noted will be quickly apparent to many careful readers and the intent of the author can be discerned.

Dr. Trippensee had help in this second volume to a greater extent than in the first. Whole chapters were contributed by experts in specific fields. These are good, but Dr. Trippensee's own work in this is outstanding. Particularly in his chapters there is a wealth of sound factual information derived from proven research which will be an invaluable guide to one facing problems in the practice of wildlife management. In the opinion of this reviewer, this volume is one of the very best works in the field of wildlife management. Dr. Trippensee should be strongly urged to strengthen the first volume in a revision, which could be done by bringing that volume up to date to make this set of books a monumental achievement. Together they are a sound text for teaching the subject and a very worthwhile reference for the practitioner. Many of the gaps in our knowledge existing when parts of the first volume were written have since been filled in. The major part of the revision of it would be concerned with filling in these gaps.

In the second volume, after the two first general chapters, the third chapter, on fur bearers, treats the history and economics of the fur industry thoroughly. Following it are chapters or parts of chapters on all of the important fur animals. Anatomy, life histories, and ecology are covered under subheads. Management for each species occupies a separate section. For some species our knowledge of management techniques is limited, but the known facts are presented and the points on which additional knowledge is required are apparent. Researchers in these fields may make a substantial contribution to our conservation knowledge if they take note of these needs and fill them in.

The fourth section in the book, dealing with waterfowl, has as its first chapter a detailed presentation of waterfowl ecology . It adequately covers the habitats in each of the four major waterfowl fly-ways. The next chapter in this section, prepared originally by Dr. Gabrielson, formerly of the Fish and Wildlife Service, and revised in line with current practices, is in itself an excellent contribution. After this follow chapters on waterfowl species grouped much in accordance with their feeding habits and in line with the grouping current among ornithologists. The specific characteristics of each as they affect management are covered.

The fourth section deals with fish. This section has chapters which fall into two divisions: fresh water game fish in a cold water habitat, and fresh water game fish in a warm water habitat. Under each of these the management of the various types of water bodies are thoroughly treated. Included are streams, lakes, great ponds, and farm ponds. Then, in addition to these, there are chapters on the warm water game fish themselves, as well as on the cold water game fish. Each chapter is divided into sections by important species and contains a wealth of essential factual information.

Every chapter is followed by a bibliography which contains references specific to the subject matter covered. References in the text are marked by a number which refers to this bibliography, or a number followed by the letters *g.r.* which refers to a general bibliography. A thorough index is included. The text is illustrated with numerous maps, photographs, and line drawings. The sketches which follow each chapter are particularly attractive.

Dr. Trippensee is to be congratulated by foresters and wildlife managers for this fine contribution.

RICHARD M. MAY

Lespromkhoz as an Administrative and Production Unit.

By P. Nikitin. 82 pp. Mimeo. Research Program on the U.S.S.R., East European Fund, Inc. New York, 1953. $0.95.

This publication offers the rare opportunity to read in English a detailed account of the operation of a forest industry enterprise under communism. It is number 48 in a series of studies on the Soviet Union.

Mr. Nikishin (Nikitin under the title of the publication is a misprint) writes from personal experience as a forester in the Ukraine up to the time of the German invasion. The organization of the *lespromkhoz* (*lesnoye promyshlennoe khosyaistvo*), the primary administrative and production unit of a timber trust of the Soviet timber industry, is described in detail. Although the examples given apply probably only to conditions prevailing in the western Ukraine before World War II, the general principles of the system still hold for the entire Soviet Union.

The first chapter reviews the development of the forest administration since the revolution, leading to the decree of the Council of the People's Commissars of 1936 by which the forests of the U.S.S.R. were divided into timber-produc-

One of a series of advertisements appearing in several national magazines in the interest of better public understanding of tree farming and the forest products industry.

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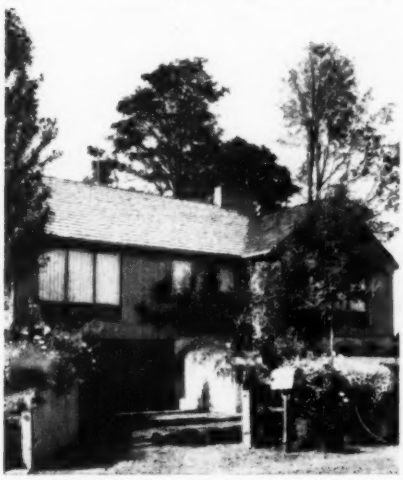

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tion and watershed-protection forests, to which later was added a third class of special protection forests. The field of forestry and forest industry was divided in a territorial as well as functional basis between the Ministry of Timber Industry, (since 1953 the Ministry of Timber and Paper Industry), and the Ministry of Forestry (now in the Ministry of Agriculture and Procurements).

The timber-production forests, located generally in northern European Russia and Siberia, are under the Ministry of the Timber Industry. The utilization of these forests is guided by the requirements of the national economy and by the production quotas set up in the 5-year plan. The *lespromkhozy* operate logging camps, sawmills, woodworking establishments, and concentration yards in their assigned territory.

Forest protection and regeneration are the task of *leskhozy*, the local administrative units of the Ministry of Forestry. The cutover land is often transferred from the jurisdiction of the Ministry of Timber Industry to the Ministry of Forestry. The watershed-protection forests, located in the drainage basins of the Dnepr, Don, Volga, and Ural Rivers, are under the jurisdiction of the Ministry of Forestry and are managed on a sustained yield basis. Here the *leskhozy* are in charge of the forest and sell the stumpage to the *lespromkhozy*.

The second and third chapters describe the functions and the structure of the *leskhozy* and *lespromkhozy*. Chapters four and five discuss the personnel, production plan, and cost-accounting system of the various activities of a *lespromkhoz*. The following four chapters deal with timber appraisal, exploitation, transportation, processing, and marketing of forest products, accounts with the timber trust to which the *lespromkhoz* belongs, general material control, and wages.

In the following quotations the author points out the weaknesses of the system. "The control of the forest economy and of the lumber industry is, by its very structure, complex and bureaucratic. Over the local units—the *leskhoz* and the *lespromkhoz* — there are superimposed three to four control offices. As a result, there is much correspondence, planning of various types and criss-crossing of accounting procedures, and a lack of direct technical assistance to the basic units.

"Since control of the timber-production forests is under the control of the Ministry of Timber Industry, the forest is transformed into a timber mine. All efforts are bent toward the fulfillment of the various plans at any price.

"Due to excessive production norms and low evaluations, the pay of the workers is very inadequate. Hence the continuous labor turnover, absenteeism, compulsory assignment of workers to the timber camps, and the use of unpaid labor prisoners.

"The sector beset by the most difficulties is the transportation sector.

"A general characteristic of the Soviet setup is Party favoritism, the gradual replacement of qualified non-Party specialists with young and inexperienced Party specialists. This tendency, and the

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ever-present secret surveillance by the 'special section,' create a state of tension and a lack of self-confidence on the part of the non-Party personnel.

"It can easily be deduced from the diagrams (presented in the text) of the management and control administrations, that the entire Party section of the structure, such as the directors, the chiefs, the supervisors, the managers, and the 'special' personnel, would, under any normal conditions of production and industrial relationships constitute merely a wasteful burden in the general composition of the technical and service personnel of the respective enterprises."

The author considers the production plan and the cost-accounting system as positive features of the Soviet order. "They make it a simple matter for people who are hardly literate to orientate themselves in problems of production and administration; they define production interrelationships and forestall all sorts of conflicts."

Mr. Nikishin should be commended for giving the American reader an on-the-ground picture of the Soviet forest enterprise. Because of the complexity of the subject the publication cannot be classed as easy reading, but the wealth of detail presented make a careful study of the text well worthwhile.

R. Stahelin

Vegetation and Watershed Management

By E. A. Colman. 412 pp. Illus. Ronald Press Company, New York, N. Y. 1953. $7.

During recent years, public interest in the protection and management of watershed lands has grown rapidly. This is illustrated by widespread demands for flood prevention and improved management of upstream watershed lands; and by the organization of associations of people interested in improving their watershed lands.

Such demands for watershed improvement lead to corresponding demands for adequate knowledge on how to improve watersheds. It is not easy to satisfy this need. Because the watershed conservation movement is relatively new on our continent, research and experience have not yet built a well-organized fund of knowledge upon which watershed management can be based. This has sometimes meant poor planning of watershed improvement, and ill-founded claims for the benefits of such work. It also points out the need for the organized assembly of all available knowledge on watershed management, so that planners and land managers can have a reliable source of information at hand as they do their work.

In response to this need, the Conservation Foundation asked Dr. Colman to review available information and to prepare a reference work on the relation of vegetation to water yields and watershed management. This book is the result. It is a first-class contribution to knowledge, and should go a long

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way toward filling present gaps in readily available information.

In his foreword, Dr. Fairfield Osborn has indicated the purpose and scope of this book so well that his statements deserve direct quotation:

> "The key relationship Dr. Colman investigates is that of vegetation management to water control and supply. . . . Because the quality, timing, and quantity of water delivered from many watersheds are often not satisfactory, much study has been given in recent years to the possibility of 'managing' vegetation to improve the way water comes off the land. . . .
>
> "Dr. Colman's book is, in effect, a comprehensive survey of the control, by vegetation means, of water on the land, beginning at the point where precipitation strikes the foliage, and ending with the influence of management practices on stream-flow, on channel stability, and on ground-water storage. Part of this discussion of vegetation management deals with its use as a technique in flood control."

The book deals with structural control of water only incidentally. It does not include techniques for hydrologic analysis, and it treats microclimate and forest influences only as they bear on the main subject. It does not go into the management of vegetation for crops other than water. All of these features are good; they mean that the book is focused on watershed management, without unnecessary diffusion into related fields.

As to the actual organization and contents of the book, it is divided into three parts. Part I, "Water Yield and Its Control," is a general presentation of the watershed management problem. It includes an introduction and definition of the book's scope; a broad picture of water yields through the United States, including their areal and seasonal distribution and the major factors affecting water yields; and an outline of the important problems involved in controlling water yield. These include floods, sediment production, the regimen of streams, and water quantity.

As indicated by its title, Part II deals with the principles of water yield control. In addition it goes into the relationships and uses of several methods of water control, especially the relations of vegetation and structures. The depiction of principles is aided by the author's comparison of a watershed to a reservoir behind a dam. This analogy is interesting but has some obvious imperfections.

The third and final part of the book is devoted to applying the principles discussed in Part II. It starts by outlining the vegetation regions of the United States. Supporting these discussions is a colored map which shows consolidated vegetation types and predominant kinds of cultivation. The text descriptions give an excellent depiction of these types.

Dr. Colman divides research that has been done by a variety of agencies, on both cultivated and non-cultivated land, into five categories:

1. Studies designed to develop a better understanding of hydrologic processes; the so-called basic researches.
2. Studies designed to measure quantities involved in hydrologic processes, as for example, interception losses.

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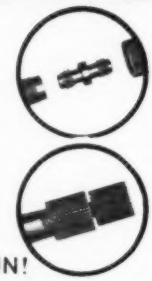

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3. Studies in which alternative kinds of vegetation are compared in relation to water control.
4. Studies of ways to minimize or correct damage caused by use or misuse of the land.
5. Studies of vegetation changes made primarily to improve water yield.

Concentrating especially on the last three of these categories, the author then presents a reasonably complete picture of the results of research.

As the reviewer approached the end of this well-rounded treatise, he started looking for concrete recommendations leading toward better land management. These are implied in the many results of research; but it was hoped to find more real prescriptions in the final chapter, "The Opportunities and the Challenge." The relative lack of such prescriptions does not, however, reflect upon the book or upon the author's grasp of his subject. Perhaps it reflects more nearly upon the current stage of development of the art of watershed management. At present we have begun to collate the results of research and experience; the next step is to interpret these facts in terms of actual land management. This will require the continued contribution of many workers in this field, over a period of time.

As often happens in formal reviews, this one may seem to highlight the flaws in Dr. Colman's book rather than its many virtues. Any such reaction should be heartily counteracted by the assurance that this is an excellent introduction to watershed management for people interested in this field. It should find widespread use by students and teachers, as well as by engineers, foresters, agronomists, and other technicians. And it will provide an excellent foundation for the further development of sound practices in applied watershed management.

Harold G. Wilm

Publications of Interest

The 288 page 1953 *Annual Proceedings* issue of the *Journal of the Forest Products Research Society* was published and mailed to members late in December. This marks the seventh consecutive year the society has published a proceedings issue. Some forty articles cover eight areas of activity in the wood industry. Subjects covered intensively include: quality control; glues and gluing; chemical utilization; containers and protective packing materials; wood finishing; wood composition board; wood machining and equipment; and drying and preservation.

The 1953 proceedings, which features highly readable format and a heavy, flexible paper cover, is available from the executive secretary, FPRS, P. O. Box 2010, University Station, Madison 5, Wis., at $7.00 per copy. Hard cloth covers are available at $2.00 extra.

Past issues of the annual proceedings number are available from the society at the following prices: Vol. 1, $6.00; Vols. 2, 3 and 4, $8.00 each; Vol. 5, $10.00; and Vol. 6, $7.00.

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Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University of New York College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

Eastern Red Cedar. By H. S. Betts. 4 pp. U. S. Forest Serv., Washington 25, D. C. 1953. American Woods (rev.) 5 cents.

Forestry and Paper, 2d ed. 34 pp. Illus. P. H. Glatfelter Co., Spring Grove, Pa. 1954.

Land and Water Trails. By Ellsworth Jaeger. 227 pp. Illus. Macmillan Co., New York. 1953. $2.95.

Ponderosa Pine. By H. S. Betts. 8 pp. U. S. Forest Serv., Washintgon 25, D. C. American Woods (rev.) 5 cents.

Farm Forestry

Farm Forestry Extension; What It Is and How It Works. By W. K. Williams. 14 pp. Illus. U. S. Forest Serv., Washington 25, D. C. 1953. Agric. Info. Bull. No. 107.

Georgia Woodland Management. By C. D. Dyer, A. E. Patterson and D. J. Weddell. 32 pp. Illus. Univ. of Georgia Agric. Ext. Serv., Athens. 1953. Bull. No. 578.

National Farm Woodlot Conference Proceedings, Chicago, Ill. June 25 and 26, 1953. 101 pp. American Forest Products Industries, Washington 6, D. C.

Forest Economics

The Structure of the Iowa Retail Lumber Industry. By Edna Douglas. pp. 221-292. Iowa State College Agric. Expt. Sta., Ames. 1953. Res. Bull. No. 395.

Forest Management

Woodland Management. By W. E. Hiley. Illus. Faber & Faber, Ltd., London. 1953. 63s.

Pathology

Cedar Rust. By R. R. Hirt. Folder. Illus. State Univ. of New York College of Forestry, Syracuse. 1953. Tree Pest Info. Serv. Leaf. No. 8.

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General Spraying and Other Practices for Control of Diseases and Insects That Attack Trees and Shrubs. By H. V. Wester. 27 pp. U. S. National Park Serv., Washintgon 25, D. C. 1953. Revised of Tree Preservation Bull. No. 6 by A. R. Thompson, 1938. 15 cents.

Birch Leaf Miner. Comp. by H. C. Miller and A. H. MacAndrews. 4 pp. Illus. State Univ. of New York College of Forestry, Syracuse. 1953. Tree Pest Info Serv. Leaf. No. 6.

Range Management

Best Grazing Rates for Beef Production on Cane Range. By W. O Shepherd and E. U. Dillard. 23 pp. Illus. North Carolina Agric. Expt. Sta., Raleigh. Bull. No. 384. October 1953.

The Halogeton Problem in Utah. By. C. M. Cook and L. A. Stoddart. 44 pp. Illus. Utah Agric. Expt. Sta., Logan. Bull. No. 364. November 1953.

The Range Resource of Alberta Foothills and Mountains. By W. R. Hanson. Canadian Cattleman, Calgary, Alberta. Vol. 16. No. 10, pp. 26-27, 30-31. October 1, 1953.

Silviculture

A Bibliography of Strip-Mine Reclamation. By G. A. Limstrom. 25 pp. Central States Forest Expt. Sta., Columbus 15, Ohio. 1953. Misc. Release No. 8.

Direct Seeding Experiments on the 1951 Forks Burn. By E. W. Shaw. 19 pp. Pacific Northwest Forest Expt. Sta., Portland, Ore. 1953. Research Paper No. 9.

Influence of Tree Crowns on Sap Production. By R. R. Morrow. 16 pp. State Univ. of New York College of Agriculture, Ithaca. 1953. Mimeog.

Partial Cuttings in Northern Hardwoods of the Lake States; Twenty-Year Experimental Results. By F. H. Eyre and W. M. Zillgitt. 124 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1953. Tech. Bull. No. 1076. 40 cents (Govt. Print. Off.).

Wildlife Management

The Grey Squirrel a Woodland Pest. 16 pp. Illus. Great Britain Forestry Comm., London. 1953. Leaflet No. 31. 9d (H. M. Sta. Off.).

Muskrat Growth and Litter Production; Pittman-Robertson Project 15-R. By R. S. Downey and A. J. Rusch. 32 pp. Wisconsin Conservation Dept., Madison 1. 1953. Tech. Wildlife Bull. No. 8.

Wisconsin Fox Population; Final Report—Pittman-Robertson Research Project 12-R. By S. H. Richards and R. L. Hine. 78 pp. Wisconsin Conservation Dept., Madison 1. 1953. Tech. Wildlife Bull. No. 6.

Wood Technology and Utilization

The Cost of Drying Lumber in Small, Electric Kilns. By G. H. Fechner. 12 pp. Illus. TVA, Norris. 1953. Forestry Investigations Tech. Note No. 20. Mimeog.

Drying Rates of Thin Sections of Wood at High Temperatures. By H. O. Fleischer. 86 pp. Yale School of Forestry, New Haven. 1953. Bull. No. 59. $1.50.

Fire-Test Methods Used in Research at the Forest Products Laboratory. 16 pp. Illus. U. S. Forest Products Laboratory, Madison, Wis. 1953. Rept. No. 1443 (rev.). Mimeog.

Manbarklak. By Eloise Gerry and J. M. Kryn. 7 pp. Tables. U. S. Forest Products Laboratory, Madison, Wis. 1953. Info. Leaf. Foreign Woods. Rept. No. 1960. Mimeog.

Relative Humidity, Moisture Content, and Dimensional Stability Relationships in Hardboard of Three Manufacturers. By J. R. Stillinger and R. A. Currier. 14 pp. Oregon Forest Products Laboratory, Corvallis. 1954. Rept. No. T-7. Mimeog.

Resume of Some of the Newer Products in Wood Utilization. By C. V. Sweet. 23 pp. U. S. Forest Products Laboratory, Madison, Wis. 1953. Rept. No. 1967. Mimeog.

Simarouba. By J. M. Kryn. 7 pp. Tables. U. S. Forest Products Laboratory, Madison, Wis. 1953. Info. Leaf. Foreign Woods. Rept. No. 1956. Mimeog.

Small Wood Industry—Home Markets. By C. V. Sweet. 10 pp. Illus. U. S. Forest Products Laboratory, Madison, Wis. 1953. Rept. No. 1968. Mimeog.

Spanish Cedar. By J. M. Kryn. 14 pp. U. S. Forest Products Laboratory, Madison, Wis. 1953. Info. Leaf. Foreign Woods. Rept. No. 1948. Mimeog.

The Strength Properties of Timber. By F. H. Armstrong. 41 pp. Illus. Great Britain. Dept. of Sci. and Indus. Research. Forest Products Research, London. 1953. Bull. No. 28. 2s.

Utilization of White-Pocket Douglas-Fir in Containers. By E. V. Briggs. 5 pp. Illus. U. S. Forest Products Laboratory, Madison, Wis. 1953. Rept. No. 1959. Mimeog.

Wood—A Simple Explanation; What It Is and How We Use It. By F. J. Champion. 7 pp. U. S. Forest Products Laboratory, Madison, Wis. 1954. Rept. No. 1972. Mimeog.

Society Affairs

Officers and Council

1954-1955

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Kimberly-Clark Corporation
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College of Forestry
Syracuse 10, N. Y.

J. Herbert Stone
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Portland 8, Ore.

Ruthford H. Westveld
Department of Forestry
University of Missouri
Columbia, Mo.

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L. Audrey Warren
Business Manager

Lloyd Thorpe
Advertising Representative

FISCAL YEAR MEMBERSHIP CAMPAIGN

School Box Score

School	Student applications received: April listing	Student applications received: Total fiscal year
Alabama Polytechnic Institute	1	5
University of California	4	19
Colorado A & M College	1	12
Duke University	1	7
University of Florida	2	15
University of Georgia	3	29
University of Idaho	0	8
Iowa State College	2	23
Louisiana State University	0	5
University of Maine	0	10
University of Massachusetts	1	16
Michigan State College	3	18
University of Michigan	2	9
University of Minnesota	0	17
University of Missouri	0	16
Montana State University	0	8
State University of New York	1	10
North Carolina State College	0	18
Oregon State College	3	12
Pennsylvania State University	6	14
Purdue University	0	18
Utah State Agricultural College	0	7
University of Washington	3	17
West Virginia University	0	6
Yale University	1	1
Totals	34	320

FISCAL YEAR MEMBERSHIP CAMPAIGN

Section Box Score

Section	Applications received[1]: Proposed 1954 quota	April listing	Total fiscal year
Allegheny	100	8	28
Appalachian	100	3	31
Central Rocky Mountain	45	3	16
Central States	110	6	53
Columbia River	140	6	24
Gulf States	105	3	16
Inland Empire	30	5	13
Intermountain	30	1	9
Kentucky-Tennessee	30	0	1
New England	95	4	37
New York	65	3	18
Northern California	120	4	27
Northern Rocky Mountain	30	1	13
Ozark	55	4	25
Puget Sound	80	9	30
Southeastern	145	15	84
Southern California	20	1	1
Southwestern	35	0	4
Upper Mississippi Valley	60	4	46
Washington	45	2	6
Wisconsin-Upper Michigan	60	0	0
	1,500	82	482

[1]Student, Junior, Affiliate, Associate (initial) grades only.

Coming Events

Intermountain Logging Conference

April 1-3, Spokane, Wash.

Pennsylvania Forestry Association

The annual meeting of the Pennsylvania Association will be held at State College, Pa., April 27-28.

Columbia River Section

The annual meeting of the Columbia River Section will be held in Portland, Ore., April 10.

Southern Forestry Conference

Sponsored by Forest Farmers Assoc. April 26-27, Battery Park Hotel, Asheville, N. C.

Forest Products Research Society

The 1954 meeting of the Forest Products Research Society will be held in Grand Rapids, Mich., May 5, 6, and 7, under the direction of Fred E. Dickenson, national meeting chairman.

Gulf States Section

The Gulf States Section will hold its spring meeting at Alexandria, May 6-7.

Allegheny Section

The summer meeting of the Allegheny Section will be held at Mont Alto, Pa., June 11-12.

American Forestry Association

The annual meeting of the American Forestry Association will be held at the Multnomah Hotel, Portland, Ore., September 6-9.

Society of American Foresters

Annual meeting, Hotel Schroeder, Milwaukee 3, Wis., October 17-20.

For a list of Division Officers, Section Officers, Society Committees and Representatives, and Colleges and Universities in the United States Offering Instruction in Forestry—see pages 316 to 320.

The President's Column

E. L. DEMMON

Let us not overlook the objectives of our Society as formulated by the founders in 1900: To represent, advance, and protect the interests and standards of the profession of forestry; to provide a medium for exchange of professional thought; and to promote the science, practice, and standards of forestry in America.

Among the best sounding-boards for exchange of professional thought are the periodic gatherings of the Chapters and Sections, where forestry issues can be thoroughly aired. These gathering provide an opportunity for the rank and file of members to discuss technical problems at the grass root level, and, even better, to get into the field and examine forestry practices on the ground.

A relatively small proportion of our members finds it possible to attend the annual national meetings, but opportunities should be available for practically every member to attend one or more local meetings per year. Some Section meeting attendance has reached into the hundreds, which would have made very respectable-sized gatherings at annual meetings of the Society only a few year ago.

During January I had an opportunity to attend the annual meetings of two of our Sections (Appalachian and Southeastern). I was particularly pleased with the variety and quality of the technical discussions. Most of these were presented by younger members and were well thought out and well prepared. The only criticism I might make, and this applies to many technical programs, was the lack of time for adequate discussion. This is a matter for careful consideration by all program committees.

Although the JOURNAL OF FORESTRY probably will continue to be our best medium for exchange of professional thought, let us use our Chapter and Section meetings to the fullest extent for that purpose. This will result in added opportunities for more of our members to share in Society activities, and to come away with stronger feelings that we are a real professional Society and that he has had an active part in making it so. It should also give impetus to the membership campaign.

E. L. Demmon

NEW YORK SECTION OFFICERS CHANGE. They are left to right: Donald Welch, newly elected to executive committee; Allan W. Bratton, newly elected chairman; John W. Barrett, newly elected secretary-treasurer; Fred E. Winch, retiring chairman; Jas. E. Davis, retiring secretary-treasurer.

M. A. Mansell (1899-1954)

Maurice A. Mansell of Stoddard, N. H., died February 6 as the result of an automobile accident. He was forest manager of the Andorra Forest in Stoddard, N. H., a private tract of nearly 8,000 acres.

Born August 27, 1899 at Greenville, Maine, Mr. Mansell subsequently was graduated in forestry from the University of New Hampshire in 1924. During his forestry career, he was employed in the White Mountain National Forest, as a technical forester with the Civilian Conservation Corps, and as a consulting forester. He had been forest manager of the Andorra Forest since 1938.

He was a Member of the Society of American Foresters, chairman of the Cheshire County Forest Advisory Board, and was active in civic affairs.

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Executive Secretary Reappointed

Article VI, Section 2 of the Constitution provides that ". . . the Executive Secretary shall be appointed by the Council which is empowered to enter into contractural relations with him during the period not exceeding two years for which he is appointed."

By letter ballot, the Council voted to reappoint Henry Clepper as executive secretary for the biennium 1954-1955.

"Forest Cover Types" Manual Now Available

The new (1954) edition of the forest cover types manual, combining *Forest Cover Types of the Eastern United States* and *Forest Cover Types of Western North America*, is now available at $1 per copy, postpaid. This long-awaited revision, *Forest Cover Types of North America* contains detailed description of approximately 250 North American forest types (exclusive of Mexico), giving composition, occurrence, importance, associates, plan in succession, and variants and synonyms. A comprehensive table lists common and technical names of tree species with authority of the new Forest Service "Check List." An index of forest types is included.

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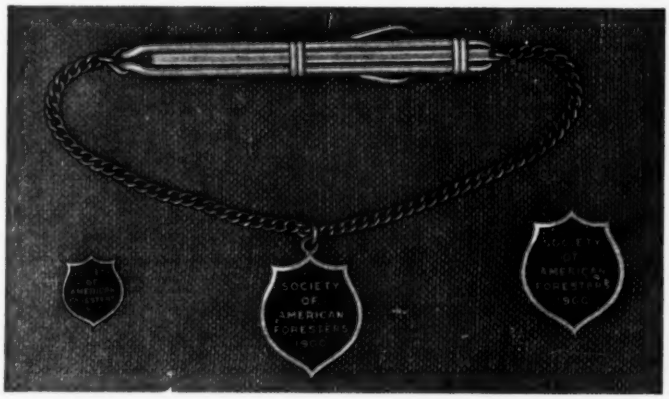

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Ozark Section Officers are, from left to right, F. M. Meade, secretary-treasurer, Paul Y. Burns, vice chairman, Albert Eagstrom, chairman, Peter W. Fletcher, retiring chairman.

New York Section Meeting

The annual winter meeting of the New York Section was held January 27-29 at Albany. It opened with an afternoon field trip to a sash gang sawmill.

Indoor sessions were held January 28 in Brubacher Hall, New York State College for Teachers. The subject of the technical papers was the utilization of small hardwoods. Donald E. Ryan presided at the morning session; Stanley Hamilton in the afternoon.

Among the speakers were Lawrence S. Hamilton, who discussed utilization problems; Fred C. Simmons, research; H. L. Field, pulp and paper; Richard Lea, production of wood chips; and Charles H. Grothe, charcoal production.

The Section's dinner was held at the Aurania Club with Floyd Carlson as toastmaster. John Farrell told of life on Okinawa, illustrated by color film.

At the morning business session on January 29 chairman Fred E. Winch, Jr. presided. Following the presentation of committee reports, Henry Clepper discussed Society activities.

Total attendance at the meeting was 100.

New officers were elected as follows:

Chairman, Allen Bratton, Shelterwood, Cooperstown, N. Y.; who succeeded Fred E. Winch, Jr.

Vice chairman, Gerard A. Pesez, International Paper Company, Glens Falls, N. Y., succeeding John Stock.

Secretary-treasurer, John W. Barrett, College of Forestry, Syracuse 10; succeeding James E. Davis.

Executive Committee, Donald S. Welch, Cornell University, Ithaca, N. Y.

Ozark Section Meeting

The Ozark Section held its annual winter meeting at Little Rock, Ark., on February 5 and 6. The major portion of the meeting was given over to a discussion of forest management practices. This was broken down into three panel discussions: (1) "Goals, Needs and Functions of Optimum Management Practices," (2) "Silvical Data for Type Groups and Descriptions of Type Groups," and (3) "Cutting Guides for Mature and Immature Stands." These panels, which encouraged considerable discussion from the floor, were followed by a session on recent forestry developments within the Section. These covered work on forest genetics, progress of the Timber Resources Review, and the development of a new fire danger meter.

James Bemis, Prescott, Ark., president of the National Lumber Manufacturers Association and the Ozan Lumber Company, was banquet speaker and showed a film on wood research work at the Timber Engineering Company, affiliate of N.L.M.A.

New officers elected were: chairman, Albert Engstrom, Oklahoma City, Oklahoma Planning and Resources Board; vice-chairman, Paul Burns, Columbia, Mo., University of Missouri; secretary-treasurer, Fay Meade,

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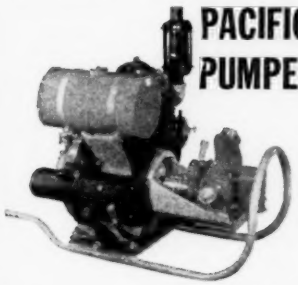

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The engine and pump are standard Pacific Units and have been fully tested and approved.

*Optional equipment.

DIMENSIONS

Length	28¾ inches
Width	19¼ inches
Height	24¼ inches

NET WEIGHT

GA-8 (without starter)	115 lbs.
GA-8-S (with starter)	140 lbs.

PERFORMANCE

Pressure	G.P.M.
50	26
100	24
150	22
200	21
250	20
300	16

Normal operation is 20 G.P.M. at 250 lb. pressure.

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SOUTHEASTERN SECTION S.A.F. OFFICERS are shown as they changed roles at the Thomasville, Georgia, meeting of January 30. From left to right the men are: Secretary-Treasurer elect F. Herbert Robertson of International Paper Co.; Chairman elect Kenneth B. Pomeroy; Vice Chairman elect and past Secretary-Treasurer Jack May of Alabama Polytechnic Institute; past Chairman Archie E. Patterson, University of Georgia; and past Vice Chairman Guyton DeLoach, Director of conservation for the State of Georgia.

Fayetteville, Ark., University of Arkansas.

A total of 149 members registered for the meeting.

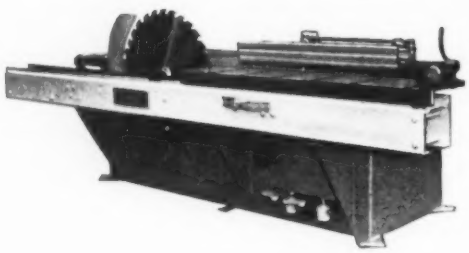
Southeastern Section Meeting

Nearly 350 foresters and their ladies converged on Thomasville, Georgia, for the 14th annual meeting of the Southeastern Section. Fifteen technical papers, covering the major phases of Southeastern forestry were presented by an able and well-informed corps of members.

After a brief business meeting outgoing Chairman Archie E. Patterson of the University of Georgia turned the reins of office over to Kenneth B. Pomeroy of the Lake City (Florida) Research Center. Jack T. May of Alabama Polytechnic Institute succeeded Guyton DeLoach of the Georgia Forestry Commission as vice chairman, while F. H. Robertson, Jr. of International Paper succeeded May as secretary-treasurer.

The next meeting will be held in Jacksonville, Florida, in January 1955.

SHORT LOG BOLTER



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Inland Empire Section Meeting

The Inland Empire Section held its annual winter meeting in Spokane on January 23. A half-day panel presentation was followed by a social hour and banquet in the evening.

Following a short business meeting, a panel discussion was held on the topic "The Impact of New Developments on Forestry in the Inland Empire." The panel moderator was Marion N. Nance, district forester, U. S. Bureau of Land Management, Spokane. New developments in the field of forest utilization were summarized by I. V. Anderson, head of the Forest Utilization Service, Intermountain Forest and Range Experiment Station, Missoula, Mont.

The effects of these developments on various aspects of forestry were then handled by other panel members. Axel Lindh, assistant regional forester in charge of timber management, U. S. Forest Service, Missoula, discussed effects on timber management. Royce Cox, forester, Potlatch Forests, Inc., Lewiston, Idaho, discussed the effect of new developments on silvicultural practices. Dean Ernest Wohletz, College of Forestry, University of Idaho, Moscow, discussed the effect on forest economies. Supervisor George Duvendack, St. Joe National Forest, St. Maries, Idaho, covered the effect on forest protection.

The Section's annual banquet was held that evening with Grant B. Potter, forester, Ohio Match Company, Coeur d'Alene, Idaho, as toastmaster. Highlight of the banquet was the presentation of the certificate of award commemorating the election of James C. Evenden of Coeur d'Alene, Idaho, to the grade of Fellow in the Society. The award was presented by P. D. Hanson, newly elected Council member from the Northern Rocky Mountain Section.

Following a short period of entertainment, Lawrence R. Pugh, St. Maries Lumber Company, St. Maries, Idaho, gave an interesting illustrated talk on his trip with American lumbermen to Europe last summer.

Despite blizzard conditions preceding the meeting, approximately 65 Section members were present for the day's program. A number of the members' wives joined them for the banquet in the evening.

JOHN O. HERRON, JR.,
Secretary-Treasurer.

Meeting of Upper Mississippi Valley Section

The annual meeting of the Upper Mississippi Valley Section was held at the School of Forestry, University of Minnesota, St. Paul, February 12 and 13.

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Chairman A. E. Schneider presided at the business session. The secretary-treasurer's report was presented by E. I. Roe.

Other committee reports were presented as follows: Membership, by J. Donald Meyer; Silviculture, Floyd Colburn; Protection, E. J. Jankowski; Economics, Lynn Sandberg; and Forest Management by M. B. Dickerman and Earl Adams. Dr. Frank H. Kaufert, director of the Society's forestry research project, reported on the status of the inquiry.

D. P. Duncan served as chairman of the session on farm forestry, on which subject a panel discussion was a highlight of the meeting. Six Minnesota farmers comprised the panel, the moderator of which was Dwight W. Bensend.

Ways in which the needs of small forest owners might be met were discussed by the following persons: R. B. Campbell, education; Floyd T. Ryan, public services; and F. T. Frederickson, industrial assistance.

The Section dinner served in the Radisson Hotel on February 12 was attended by more than one hundred members and their ladies. Talks were given by Henry Clepper on Society projects for 1954 and by Bernard L. Orell on "Human Relations in Forestry."

The concluding feature of the meeting was a conducted tour on the morning of February 13 of the University of Minnesota's well known St. Anthony Fall Hydraulic Laboratory.

Unique feature of this year's program is a "bull of the woods", who will officiate as a speech squelcher. Individual talks are to be limited to ten minutes each.

The annual banquet in the evening will feature a talk to be given by a top-notch public relations man, as yet undesignated, who will explore the latent public relations possibilities in foresters as individuals and in their work.

Columbia River Section Meeting

The annual meeting of the Columbia River Section will be held in Portland, Oregon, on April 10. Represented in this get-together will be the Longview, Wash., chapter and the Portland, Willamette Valley, Siskiyou, Umpqua-Coquille, Blue Mountain, Central Oregon and Shasta-Cascade chapters in Oregon. Expected attendance will be 300.

According to program chairman George Schroeder, the theme of this year's meeting will be "Tree Roots Public Relations." Each chapter will have one or two men present the highlights of the public relations job as it is being done in the individual chapter area, on a practicing forester level.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of February are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of May 1, 1954. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Beers, T. W. — Thomas, R. J.
Eckert, P. L. — Tyson, K. L.
Kohler, J. F. — Yehl, R. K.

Junior Grade

Clark, P. M., Forester, Dept. of Forests & Waters, Mifflinburg, Pa.; Pa. State, B.S.F., 1952.

Kohler, J. F., 972 Fritz St., Johnstown, Pa.; Pa. State, B.S.F., 1954. (Student, 1954).

Member Grade

Brown, L. R., Asst. Dist. Forester, Dept. of Forests & Waters, Ligonier, Pa. (Junior, 39R49).

Gray, J. F., Consulting Forester, Turner & Shannon, Kittaning, Pa.; Pa. State, B.S.F., 1948. (Junior, 1948).

Seidel, H., General Mgr., Reisen Hardwood Lbr. Co., Union, N. J. (Junior, 1947).

Shade, E. B., Grad. Asst., Univ. of Minn., St. Paul, Minn. (Junior, 1946).

Troop, B. S., Wood Technologist, Tbr. Engineering Co., Washington, D. C. (Junior, 1947).

Affiliate Grade

Sushko, W. C., Forester, Watersheds Bur. of Water Supply, Baltimore, Md.; Institute of Soil Culture, Austria, F.E., 1946.

Appalachian Section

Student Grade

DUKE UNIVERSITY

Turner, R. G.

Junior Grade

Orr, J. L., Park Ranger, Blue Ridge Parkway, Roanoke, Va.; Colo. A. & M, B.S.F., 1952.

Yost, L. H., Trainee, Thomasville Chair Co., Thomasville, N. C.; N. C. State, B.S.F., 1953.

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE

Mast, J. R.

Junior Grade

Houston, D. M., Director, Central Neb. Pub. Power & Irr. Dist., Brady, Neb.; Colo. A & M, B.S.F., 1948.

Sullivan, R. D., Forester, Div. of Tbr. Mgmt., Denver, Colo.; Colo. A & M, B.S.F., 1951.

Central States Section

Student Grade

MICHIGAN STATE COLLEGE

Hoyer, R. C. — Retzlaff, K. C.
Moser, F. R.

UNIVERSITY OF MICHIGAN

Grow, T. R. — Leo, G. N.

Junior Grade

Parker, W. T., Forester, U. S. F. S., Bend, Ore.; Mich. State, B.S.F., 1953.

Member Grade

Muschler, A. F., Engineer, Edward Hines Lbr. Co., Chicago, Ill.; Mich. State, B.S.F., 1947; Yale Univ., M.F, 1948. (Junior, 1950).

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Erickson, J. R. — Leavitt, K. R.
Rosette, M. S.

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Junior Grade

Westman, E. F., Lab. Asst., Weyerhaeuser Tbr. Co., Longview, Wash.; Montana State, B.S.F., 1952.

Member Grade

Edin, N. A., Forester, Alley Lbr. Co., Medford, Ore. (Junior, 1947).

Ladd, C. H., Farm Forester, Ore. State Board of Forestry, Salem, Ore.; Ore. State, B.S.F., 1932. Reinstatement.

Stephens, C. A., Box 57, Rt. 2, North Bend, Ore. (Junior, 1947).

Wershing, H. F., Forester, Bur. of Indian Affairs, Portland, Ore. (Junior, 1947).

Affiliate Grade

Olson, E. E., Logger, Olson Bros. Lbr. Co., Camas, Wash.; Wash. State, B.S., (Forestry), 1953.

Snow, R. E., Owner, Snow Reforestation Service, Portland, Ore.; Univ. of Wash., B.S., (Forest Products), 1942.

Gulf States Section

Junior Grade

Craft, R. E., Forest Tech., Gaylord Container Corp., Bogalusa, La.; Iowa State, B.S.F., 1951.

Wagner, S. S., Forest Tech., Gaylord Container Corp., Bogalusa, La.; State Univ. of N. Y., B.S.F., 1951.

Weaver, B. W., Forester, Gaylord Container Corp., Bogalusa, La.; La. State Univ., B.S.F., 1952.

Inland Empire Section

Junior Grade

Mathison, R. S., Forester, U.S.F.S., St. Maries, Idaho; Montana State, B.S.F., 1950.

Rauch, G. H., Manager, Potlatch Forests, Inc., Lewiston, Idaho; Pa. State, B.S.F., 1936.

Affiliate Grade

Knapp, L. A., Timber Aide, U.S.F.S., Colville, Wash.; Wash. State, B.S., (Forestry), 1953.

Lunden, G. L., Box 114, Ione, Wash.; Wash. State, B.S., (Forestry), 1953.

Smith, E. W., 816 Spring St., Pullman, Wash.; Wash. State, B.S., (Forestry), 1953.

Intermountain Section

Junior Grade

Heninger, R. D., 3020 Wall Ave., Ogden, Utah; Utah State Agric., B.S.F., 1952.

New England Section

Student Grade

UNIVERSITY OF MASSACHUSETTS

Arsenault, R. D.

YALE UNIVERSITY

Tessier, J. P.

Junior Grade

Cates, E. J., Forester, Great Northern Paper Co., Rockwood, Maine; Univ. of Maine, B.S.F., 1950.

Santamour, F. S., Student, Yale Univ., New Haven, Conn.; Univ. of Mass., B.S.F., 1953.

Member Grade

Gould, E. M., Lecturer, Harvard Forest, Petersham, Mass.; Univ. of N. H., B.S.F., 1940; Harvard Univ., M.F., 1942. (Junior 1947).

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Marks, R. J.

Junior Grade

Gammon, E. R., Forester, N. Y. State Cons. Dept., Albany, N. Y.; State Univ. of N. Y., B.S.F., 1942.

Hughes, E. L. Research Forester, Dept. Lands & Forests, Maple, Ont., Canada; Univ. of Toronto, B.S., (Forestry), 1950; Univ. of Mich., M.F., 1953.

Member Grade

Haderup, G. S., Forest Surveyor, N. Y. Cons. Dept., Fleischmanns, N.Y. (Junior, 35R48).

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Burton, L. R. Miller, H. R.

Laursen, V. R. Rusk, J.

Junior Grade

Armstrong, G. H., 106 Coloma St., Placerville, Calif.; Wash. State, B.S., (Forestry), 1951. (Affiliate, 1952).

Cope, R. H., 294 Madison St., Vallejo, Calif.; Univ. of Calif., B.S.F., 1954. (Student, 1953).

Northern Rocky Mountain Section

Junior Grade

Kauffman, D. T., Grad. Asst., Montana State, Missoula, Mont.; Montana State, B.S.F., 1953.

Member Grade

Gregson, R. L., Dist. Forest Ranger, U.S.F.S., Trout Creek, Mont.; Montana State, B.S.F., 1946. (Junior, 1946).

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University of California

F. Fraser Darling,
University of Edinburgh

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Ozark Section

Junior Grade

Kucera, C. L., Asst. Prof., Univ. of Mo., Columbia, Mo.; Iowa State, B.S.F., 1947; M.S., 1948; Ph.D., 1950.
Postlethwait, S. F., Forester, U.S.F.S., Danville, Ark.; West Va. Univ., B.S.F., 1951.
Ross, H. L., 425 Prairie Ave., Fayetteville, Ark.; Iowa State, B.S.F., 1951.

Member Grade

Grano, C. X., Industrial Forester, 903 Elm St., Crossett, Ark. (Junior, 1947).
Hamblen, E. G., Industrial Forester, Box 206, Crossett, Ark. (Junior, 1947).

Associate Grade

Peterson, J. E., Instructor, Univ. of Mo., Columbia, Mo.; Mich. State, M.S., 1952.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Junk, R. W. Walton, P. T.
Millo, C. E.

Junior Grade

Johnson, R. F., Logging Eng., Scott Paper Co., Everett, Wash.; Univ. of Wash., B.S.F., 1949.
Kerlee, J. D., Land Agent, Weyerhaeuser Tbr. Co., Snoqualmie Falls, Wash.; Univ. of Wash., B.S.F., 1938.

Member Grade

Alexander, M. T., Asst. Br. Forester, Weyerhaeuser Tbr. Co., Vail, Wash.; Univ. of Wash.; B.S.F., 1943; Univ. of Mont., M.F., 1949. (Junior, 1948).
Little, G. R., Forester, State Div. of Forestry, Chehalis, Wash.; Univ. of Wash., B.S.F., 1950. (Junior, 1950).
Smith, R. E., Logging Activity, Arnot-Smith Tbr. Co., Ltd., Vancouver, B. C., Canada. (Junior, 1947).
Tollheim, R. H., Dist. Ranger, Naches Ranger Sta., Naches, Wash.; Univ. of Wash., B.S.F., 1948. (Junior, 1948).

Affiliate Grade

Rudinsky, J. A., Asst. Forest Entom., Weyerhaeuser Tbr. Co., Centralia, Wash.; Ohio State Univ., Ph.D., (Entomology), 1953.
Schmeller, J. J., Forester, Sauk Rgr. Sta., Concrete, Wash.; Wash. State, B.S. (Forestry), 1953.
Wefer, F. W., Box 270, Rt. 5, Bellingham, Wash.; Wash. State, B.S. (Forestry), 1953.
Wiksten, N. A., Asst. Research Forester, Weyerhaeuser Tbr. Co., Centralia, Wash.; Royal School of Forestry, Sweden, M.F., 1941.

Southeastern Section

Student Grade

ALABAMA POLYTECHNIC INSTITUTE

Cathcart, J. R.

UNIVERSITY OF FLORIDA

Lunday, A. N. Brock, G. A.

UNIVERSITY OF GEORGIA

Garrett, W. G. Parish, K. L.
Howard, W. H.

Junior Grade

Chellman, C. W., Grad. Asst., Univ. of Fla., Gainesville, Fla.; Univ. of Fla., B.S.F., 1951.
Clark, A. G., Forester, St. Marys Kraft Corp., St. Marys, Ga.; Univ. of Fla., B.S.F., 1949.
Eldridge, T. S., Dist. Ranger, U. S. F. S., Centreville, Ala.; Pa. State, B.S.F., 1943.
Hinkle, R. J., Forester, Container Corp. of America, Leesburg, Fla.; W. Va. Univ., B.S.F., 1950.
Kennedy, J. J. B., Forester, U. S. F. S., Heflin, Ala.; Univ. of Fla., B.S.F., 1950.
Maxwell, K. F., Forest Tech., International Paper Co., Gainesville, Fla.; Univ. of Fla., B.S.F., 1950.
Morrow, W. H., N. Washington St., Russellville, Ala.; Univ. of Ga., B.S.F., 1949.

Affiliate Grade

Denyer, W. H., Box 735, Bainbridge Air Base, Ga.; Okla. A & M, B.S., (Forestry), 1953.
Wilson, D. E., Forester, Southern Resin & Chemical Co., Glen St. Mary, Fla.

Southwestern Section

Junior Grade

Jones, M. F., Dist. Forest Ranger, U. S. F. S., Clarkdale, Ariz.; Utah State Agric., B.S.F., 1936, Reinstatement.

Southern California Section

Junior Grade

Collins, D. D., Asst. Engineer, Core Laboratories, Inc., Bakersfield, Calif.; Univ. of Maine, B.S.F., 1952.

Upper Mississippi Valley Section

Student Grade

IOWA STATE COLLEGE

Blyth, J. E. Miller, C. W.

Junior Grade

Leinfelder, R. P., Forester, Iron Range Resources & Rehabilitation Comm., Hibbing, Minn.; Univ. of Minn., B.S.F., 1952; M.F., 1953.

Member Grade

Barkovic, R., Dist. Forester, Minn. & Ont. Paper Co., International Falls, Minn.; Univ. of Minn., B.S.F., 1941 (Junior, 1946).
Binger, C. R., Forest Mgt. Officer, Ont. Minn. Pulp & Paper Co., Ltd., Fort Frances, Canada; Univ. of Minn., B.S.F., 1946; Yale Univ. M.F., 1941. Reinstatement.

Associate Grade

Butcher, J. W., Entom., Univ. of Minn., St. Paul, Minn.; Univ. of Minn., M.S., 1949; Ph.D., 1951.

Washington Section

Junior Grade

Mumma, W. M., Member, House of Representatives, Washington, D. C.; Pa. State Forest Academy, B.S.F., 1911.

Associate Grade

Robertson, R. M., Scien e Dir., Office of Naval Res., Washington, D. C.; Univ. of Glasgow, M.A., (Mathematics & Physics), 1932; Mass. Institute of Technology, Ph.D., (Physics), 1936.

C. V. Sweet (1892-1954)

Carroll V. Sweet, well-known lumber expert at the Forest Products Laboratory, died January 26. He was 61 years of age.

For 28 years he headed the Laboratory's division of industrial investigations, a post that kept him in close contact with technical and economical problems of the wood-using industries. He directed research on logging, sawmilling, woodworking, the grading of lumber and other wood products, and the utilization of woods and mill wastes.

Mr. Sweet was born March 14, 1892 in Phoenix, N. Y. He took a bachelor's degree in forestry at the College of Forestry, Syracuse, in 1915, and master's degree the following year.

He joined the staff of the Forest Products Laboratory as a kiln drying specialist in 1918. In 1920, he went to India to help that country establish a forest products laboratory at Drhra Dun. Upon his return to the laboratory in 1923, he resumed his seasoning research. In 1925, he was appointed chief of the division of industrial investigations.

Author of many technical papers on forest products manufacturing, Sweet is perhaps best known for a Department of Agriculture bulletin, *Selection of Lumber for Farm and Home Building*, of which he was a joint author. One of his most significant contributions to the forest products industries was his work on grade standardization. The Laboratory has worked closely with the industry in setting up essentially the grading rules for lumber that are now used.

Forestry News

Fourth World Forestry Congress To Be Held in India

The Fourth World Forestry Congress will be held in India during December 1954 at the invitation of the Government of India and under the sponsorship of the United Nations Food and Agriculture Organization.

This will be the first Congress ever to convene outside of Europe. Its location should hold certain advantages both from a forestry and political standpoint. India will be able to show members of the congress the results of almost 100 years of continuous forest policy. The forest types should present ideal conditions for studying the results of long-applied silviculture and for the examination of a variety of logging methods. As one of the world's leaders in tropical forestry, India will also provide opportunity for foresters to take field trips into tropical forests under management.

From the political standpoint India should be acceptable as a kind of neutral ground for the forestry delegates from both sides of the Iron and Bamboo Curtains. It will enable foresters from soft currency countries to attend without too great financial sacrifice.

The past three World Forestry Congresses have afforded men working in the same and similar fields the opportunity of meeting together for the exchange of ideas and experiences. They have served as proving grounds for professional ideas. They are unique in that they are nongovernmental, and as such, afford the forest educator, industrial forester, and others in private employ their sole opportunity to meet and confer on a world basis. Attendance at these congresses is not restricted to member nations of FAO; they are open to interested citizens of every country in the world.

Each congress in the past has made important contributions to forestry. The first, held in Rome in 1926 and attended by 1,200 delegates, brought about the establishment of a silvicultural section in the League of Nations. The second congress, called in Budapest in 1936, resulted in the creation of the so-called International Forestry Center with headquarters in Berlin. This, although a Nazi-dominated affair, was the most effective forestry organization ever formed, and functioned actively until the end of World War II, when it collapsed along with the rest of the Nazi structures. The third congress, held in Helsinki, Finland, in 1949, enriched forestry literature with over 100 professional papers, and led to the movement to create a multilingual dictionary of forestry terms—something long needed, especially in the Spanish language for South and Central America. It was also the direct cause of FAO's preparing a statement of forestry principles for the assistance of nations formulating forestry policy.

The congresses, in addition, have served as milestones by which progress can be gauged and trends revealed. Against the background of the first and second congresses, it was clearly apparent that progress had been made toward certain objectives and had lagged behind in others. The contributions that forest products make to modern economy are now much better understood and appreciated than when the first and second congresses were called. So the Fourth World Forestry Congress will provide a new opportunity of gauging progress made since the last.

As of this date, no official announcement of meetings and field trips had been received from the Indian Government. A tentative program, however, has been obtained and is given here, since in all likelihood the final program will be changed only in minor details. It may be noted that one major omission exists—the subject of technical forestry training. This was a matter of such basic interest at the Helsinki meeting that it is felt almost certain time will be afforded for that subject on the final agenda.

There is no detailed information as yet regarding field trips except that they are being arranged for in India before the opening of the meeting on December 4, in New Delhi. After the meeting there will be additional field trips through both the east and west portions of Pakistan. The meeting itself is expected to open in New Delhi December 4, and continue at the famous Forest Research Institute at Dehra Dun from December 6 to 17.

Foresters attending from the United States will be in position to choose whether to go via east or west without too much time or cost differential. Those electing the Pacific route may have an opportunity of seeing the

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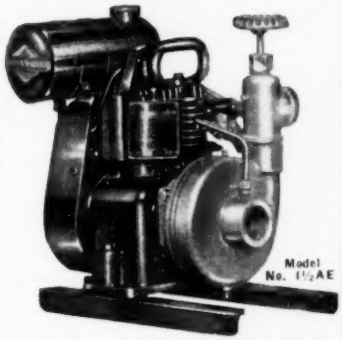

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results of forest management in the Philippines or Japan; those going east through Europe will have the same opportunity in France, Switzerland, and Germany. The fortunate ones who circle the globe can see both.

The time of year is not wholly convenient for the United States foresters, but was probably chosen because December is climatically one of the most pleasant months in northern India.

Attendance at these congresses has been an enriching experience, an opportunity to widen professional horizons that is offered once every five years at best. More than 500 attended the last congress in Helsinki, representing 27 nations and a number of international organizations. Six official delegates represented the USA; these were in addition to about 30 USA members and observers. It is hoped that for this coming congress the USA attendance will be even larger than for former ones.

The tentative agenda follows:

1. THE PRESENT STATUS OF FOREST PROTECTION AND FOREST MANAGEMENT IN THE WORLD. (Progress made since the Third World Forestry Congress.)
2. PROTECTIVE FUNCTIONS OF THE FOREST
   - (a) Forest influences (including forest grazing lands)
   - (b) Watersheds or catchment basins of valley development projects
   - (c) Reclamation of degraded soils, including deserts
   - (d) Shelterbelts
   - (e) Education in conservation. Principles of soil and water conservation
3. PRODUCTIVE FUNCTIONS OF THE FOREST
   - (a) Management for timber production and other forest products on lands under various categories of ownership, and particularly integration of forest operations with the operations of forest industries
   - (b) Management of forest lands for grazing and their integration with other fodder resources
   - (c) Management of forest lands for wildlife
   - (d) Management of forest lands for recreation
   - (e) Management of plantations outside the forest, in conjunction with agriculture or for special purposes (hedges, railway lands, roadside avenues, plantations of high productivity on agricultural lands, etc.)
4. FOREST PRODUCTS UTILIZATION
   - (a) Extraction and transport
     - (i) The status of forest workers
     - (ii) Mechanization of operations
   - (b) Utilization of hitherto little-used species, including new techniques of seasoning and preservation
   - (c) Development of key industries
     - (i) Housing and new construction material derived from wood
     - (ii) Pulp and paper
   - (d) Industries based on forest produce other than wood
     - (i) Resins
     - (ii) Tans
     - (iii) Essential oils
     - (iv) Drugs, dyes, others
5. TROPICAL FORESTRY
   - (a) Methods of increasing growth and obtaining natural regeneration
     - (i) Teak
     - (ii) Tropical rain forest
     - (iii) Mangrove
     - (iv) Bamboo
     - (v) Pine and other conifers
     - (vi) Other species
   - (b) Techniques of artificial regeneration and formation of plantations
     - (i) Seed problems
     - (ii) Nursery practices
     - (iii) Methods of formation of plantations
       - irrigated
       - nonirrigated
       - for special purposes (fuel, fodder, pulp, etc.)
   - (c) Desert control
   - (d) Shifting cultivation
   - (e) Inventories of tropical forests
     - (i) Use of aerial photographs
     - (ii) Ground sampling
     - (iii) Growth determination and predictions
   - (f) Methods of research in silviculture—application of statistical design and analysis techniques

As soon as further information comes to hand, it will be brought to the attention of our membership through the JOURNAL, together with information on travel and other matters of interest to those who plan to attend. Individual inquiries may be sent to the chairman of the S.A.F. Committee on International Relations, Tom Gill, 1214 16th Street, N.W., Washington 6, D. C.

Forest Soils Research Meeting

The College of Forestry and the Forest Soils Committee for the Douglas Fir Region sponsored a one day meeting to review research in forest soils. This meeting was held in Anderson Hall on the campus of the University of Washington on Friday, March 19. The discussion began at 9:00 a.m. and concluded with an afternoon field trip to the university's Lee Forest.

Speakers at this meeting reviewed the most recent work in forest soils and led in discussion of the needs of forest soils research. The Forest Soils Committee has been functioning since 1948. One of its primary duties is to stimulate research and make the results known to foresters.

G. N. Bishop Forestry Chairman Southern Agricultural Workers

G. Norman Bishop, professor of forestry at the University of Georgia, was elected chairman of the Forestry Section, Association of Southern Agricultural Workers at their recent meeting in Dallas, Texas. Bishop has served as secretary-treasurer of the Forestry Section and was responsible for arranging the program of the New Orleans meeting held in February, 1953. During the past year, he was vice-chairman of this Section.

The association will hold its next meeting in Louisville, Kentucky.

Forest Genetics Research Foundation Officers Elected

E. B. Babcock has been elected president of the Board of Directors of the Forest Genetics Research Foundation, and Stephen N. Wyckoff is executive vice president.

The Foundation is a private, nonprofit corporation whose efforts are devoted to assistance of research and education in forest tree improvement through grants-in-aid to schools and research agencies.

Dr. Babcock, emeritus professor of genetics at the University of California, has served the Foundation as executive vice president for the past three years.

Mr. Wyckoff was formerly director of the California Forest and Range Experiment Station of the U. S. Forest Service, with headquarters in Berkeley. He recently retired from that position after 35 years service with the U. S. Department of Agriculture. During the past 17 years he has directed federal forest research programs, first in the northern Rocky Mountains, then in the Pacific Northwest and, since 1945, in California.

James G. Eddy relinquished the presidency of the Foundation and was elected honorary president. A Northwest timberman known for his scientific leadership and financial support of forest tree breeding, Mr. Eddy established, in 1925, the Eddy Tree Breeding Station at Placerville, Calif., and later deeded it to the United States Government. Since 1935 the station, now known as the Institute of Forest Genetics, has been operated by the California Forest and Range Experiment Station, U. S. Forest Service. It is widely recognized as a center for pine tree-breeding research.

Mr. Wyckoff asked that inquiries be addressed to the Forest Genetics Research Foundation, Room 1210, American Trust Building, Berkeley 4, Calif.

Alabama Survey Shows More Forest; Less Sawtimber

Alabama has 10 percent more forest land but 12 percent less sawtimber than it had in the middle 1930's, according to a survey (completed in 1953) by the Southern Forest Experiment Station.

In announcing the results of the survey, the Forest Service points out that the timber inventory was completed almost two years ahead of schedule through cooperation from the Alabama Division of Forestry, the Tennessee Valley Authority, the Alabama Forest Products Association and several large pulp companies.

Forests cover 20,756,200 acres of the state's total land area of 32,689,920, according to the survey. This represents an increase of about 2 million acres over the first survey made in the middle 1930's. The biggest increase in forest area occurred in the central and Piedmont counties.

Alabama's supply of merchantable trees of poletimber size or larger totals 11.7 billion cubic feet. The volume in sawtimber trees is 38.2 billion board feet. The trees that help make Alabama the mid-south's leading lumber producer are chiefly the southern pines, oaks, gums, hickories and yellow-poplar.

Since the first timber survey, the volume in all merchantable softwood trees (mainly pine) has declined 5 percent. Hardwoods have increased 6 percent. For sawtimber trees alone, volume has dropped 17 percent in softwoods, 5 percent in hardwoods.

The serious decline in softwood was felt in all of the state except the southwest region, where private forest management has made great progress. There softwood sawtimber volume increased 16 percent in the 17 years between surveys.

The survey also disclosed that Alabama's timber resource supports some 3,000 sawmills, 7 woodpulp mills and more than 100 miscellaneous wood-using plants.

A full report of the survey may be secured from the Southern Forest Experiment Station, 2026 St. Charles Ave., New Orleans 13, La., or the Alabama State Forester's Office at Montgomery, Ala.

Education

Grading Short Course To Be Held at Pennsylvania

The Department of Forestry at the Pennsylvania State University is giving a short course in the grading of hardwood lumber. A National Hardwood Lumber Association representative will conduct the course.

The date is June 14 to 18, 1954. The course will cover all of the facts in grading and inspection of native hardwoods. Also consideration of thickness, measurement and manufacture, plus other questions will be answered.

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Persons desiring further information are requested to contact: Orvel A. Schmidt, Department of Forestry, Pennsylvania State University, State College, Pennsylvania.

W. B. DeVall Elected Head Forestry Committee

W. B. DeVall, head of the department of forestry at Alabama Polytechnic Institute, Auburn, has been elected chairman of the Regional Committee on Forestry Education and Research of the Southern Regional Education Board.

Mr. DeVall succeeded Dean Donald J. Weddell of the University of Georgia School of Forestry at the meeting of the committee held in Gainesville, Florida, in December.

Other actions of the forestry group included approval of cooperative plans for graduate and undergraduate instruction at the six accredited forestry schools of the South in 1954-55.

The committee will publish a uniform pre-forestry curriculum during the spring of 1954. It also stated in a resolution that no additional forestry schools are needed in the region at present.

It went on record as favoring continued effort on the part of the S.R.E.B. executive committee to reduce out-of-state fee barriers.

The group intends to devote more of its time to problems of forestry research in the future. It set its 1954 meeting at Auburn, Alabama.

Present at the meeting were DeVall; Weddell; Ralph W. Hayes, Director, School of Forestry, Louisiana State University; C. M. Kaufman, Director, School of Forestry, University of Florida; R. J. Preston, Dean, School of Forestry, North Carolina State College; C. F. Korstian, Dean, School of Forestry, Duke University; and W. J. McGlothlin and Winfred L. Godwin of the S.R.E.B. staff.

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Purdue Staff Members Study Aleutian Sea Otters

Dr. Donald E. Stullken and Dr. Charles M. Kirkpatrick, wildlife management staff members of the Department of Forestry and Conservation, Purdue University, are now in the Aleutian Islands as collaborators with the federal Fish and Wildlife Service on a research project concerning the sea otter.

The research team in charge of Dr. Ford Wilke and including Robert D. Jones, wildlife reserve manager, both of the federal Fish and Wildlife Service will reach Amchitka Island in the outer Aleutian Island chain about February 15. They will return to the mainland about April 15.

The sea otter was at one time thought by some authorities to be extinct. A few are now known to exist in several places along the West Coast, with one large colony of more than 1,500 animals at Amchitka Island. The pelt, recognized as the most valuable fur in the world has brought prices as high as $1400 per skin in a recent London fur auction.

Attempts to move animals from Amchitka for the purpose of stocking former ranges have been unsuccessful because it has been impossible to keep them alive in captivity long enough to move them. Some die within four hours of capture, the longest captive survival having been nine days. The purpose of the current project is to gain sufficient knowledge about the animal so that this difficulty may be overcome.

Hardwood Lumber Inspection and Measurement Instruction is given by Floyd Potter of St. Albans, Vt., (extreme right) field representative of the National Hardwood Lumber Association, Chicago, at the recent five day grading course at the University of New Hampshire, Durham, Jan. 25-29. Left to right, rear row, Prof. L. C. Swain, UNH Forestry Dept.; Leon Howard, Portsmouth, N. H.; W. F. Fridinger, Saco, Me.; Carl Jordan, Bethel, Me., and Prof. O. P. Wallace, UNH Forestry Dept. Front row, Howard W. Parshley, Orange, Mass.; Kenneth Lambert, Berlin, N. H.; Dean Potter, Gorham, N. H.; Adrian Gilbert, Laconia, N. H., and Clayton M. Alden, Lancaster, N. H.

Forestry on High Frequency TV Program in New York

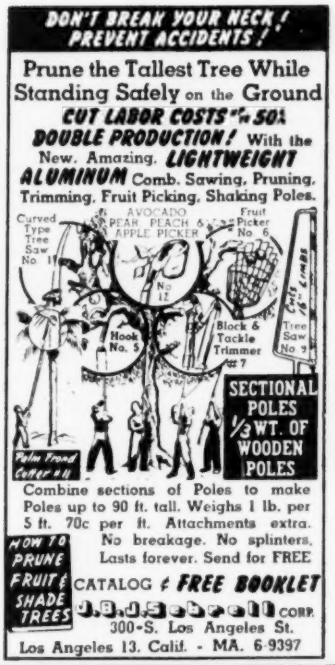
The State University of New York College of Forestry produced its first television program on the higher frequencies and the ninety-seventh to date when it presented "The Use of Small Hardwoods" over WROW-TV in Albany, N. Y., in cooperation with the New York Section Society of American Foresters, Friday, January 29. The half-hour presentation was directed by Professor Floyd E. Carlson of the College of Forestry.

Two College alumni participated: Harold L. Field, '42, Technical Supervisor, West Virginia Pulp and Paper Co., Mechanicville, N. Y.; and Charles H. Grothe, '41, Heartwood Charcoal Co., Warrensburg, N. Y.

Montana Holds School of Public Administration

The Ninth School of Public Administration was held at Montana State University, Missoula, between February 1 and 26. Begun in 1941, but interrupted during the war years, the school is designed to give persons engaged in the management and use of natural resources continuing study in areas related to administration. The seven integrated areas of study include: "Psychology of Personnel, Public Relations, Principles of Administration, Effective Public Speech, Economics of Conservation, Community Relations, and Effective Writing."

The Northern Region of the Forest Service sponsors the school, while other agencies of the region have cooperated. Sixteen men were enrolled this year and the school's graduates in past years have represented very wide geographic distribution over the country as well as a large number of conservation agencies.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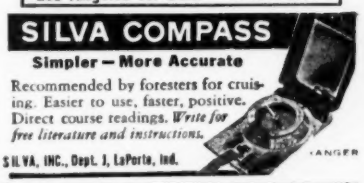
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Government

Gareth C. Moon New Montana State Forester

Gareth C. Moon, assistant state forester of Montana, was appointed state forester on March 1. He succeeded Rutledge Parker who retired after 28 years of service.

Mr. Moon was born in Crete, Illinois, in 1923. In 1949 he was graduated in forestry at Montana State University.

Following brief employment in timber management with the South Dakota Forest Service, he became assistant state forester in charge of protection. After three years in South Dakota he went to Montana as assistant state forester.

E. D. Sandvig Returns to Forest Service

Earl D. Sandvig has returned from a special mission to Chile for the Foreign Agricultural Organization to accept assignment as assistant regional forester in charge of personnel management for the Pacific Northwest region of the Forest Service, Regional Forester J. Herbert Stone has announced.

Prior to his commission in June 1952 to study range conditions and make recommendations to the Chilean government, Sandvig was chief of range and wildlife management in this region. He succeeds Bernard Anderson who was promoted recently to chief of personnel of the Forest Service in Washington, D. C.

Mr. Sandvig graduated from Montana State University in 1923 and has held numerous positions with the Forest Service since then including that of assistant forest supervisor of the Custer National Forest and supervisor of the Beaverhead National Forest, both in Montana.

Targhee National Forest Gets First Pulpwood Sale in Intermountain Region

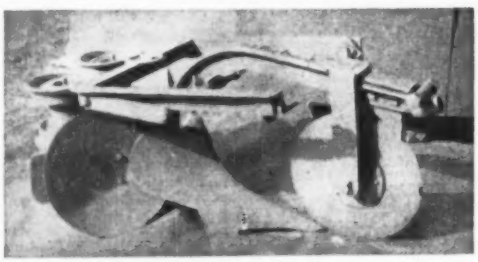
The first pulpwood sale in the history of timber cutting within the Intermountain Region was made in 1953 on the Targhee National Forest in Idaho. The present cutting is in an overmature stand of lodgepole pine that was selectively cut over in a tie operation about 25 years ago.

Clear-cutting is the objective on this pulpwood sale since the overstory stand is heavily infested with mistletoe. Advance reproduction is usually adequate in intermountain lodgepole pine stands where heavy cutting or clear-cutting has been done. If this operation proves successful, it may provide a market for thousands of acres of similar overmature lodgepole pine where a sanitation cutting is needed.

The pulpwood sticks are shipped over 1,500 miles by rail from Idaho to a pulp mill at Kaukauna, Wisconsin.

National Parks Set New Visitor Record in 1953

For the eighth year in a row, the total number of visitors to the 180 areas administered by the National Park Service set a new record during the calendar year 1953, when the count reached 46,224,794. This was



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an increase of nearly 4,000,000 over the record of 42,299,836 set in 1952.

More than half of the increase was in the figures for the national parkways; travelers on the Natchez Trace Parkway, in Tennessee, Alabama, and Mississippi, counted for the first time in 1953, total 1,425,629, while travel on the Blue Ridge Parkway, in Virginia and North Carolina, increased by more than 700,000 to a new total of 4,266,975. More people visited the 28 national parks than ever before; however the rate of increase was not as great as during the preceding two or three years.

Eleven areas attracted more than a million visitors each. These were Great Smoky Mountains National Park, Tenn., and N. C.; Rocky Mountain National Park, Colo.; Shenandoah National Park, Va.; Yellowstone National Park, Wyo., Mont., and Idaho; Blue Ridge Parkway; Colonial National Historical Park, Va.; Independence National Historical Park, Pa.; Lake Mead National Recreational Area, Ariz. and Nev.; Lincoln Memorial, Wash., D. C.; Natchez Trace Parkway and Washington Monument, Wash., D. C.

Private & Industrial

R. W. Harding Employed by Fourdrinier

Fourdrinier Kraft Board Institute, Inc., announces the appointment of Robert W. Harding, as research assistant, at their new central office, 99 Park Avenue, New York City. In his new position Mr. Harding will assist George B. Gibson, the managing director.

Mr. Harding had previously been employed by the American Creosoting Company, Newport Industries, Inc. and the Crossett Lumber Company. He received his Bachelor of Arts degree from Amherst College in 1939, and his Master of Forestry degree from Yale University in 1941.

HOO-HOO Makes Study Grant to Oregon State

A graduate study grant of $150 has recently been received from the Portland HOO-HOO Club by the School of Forestry, Oregon State College. The award will be given to a graduate student majoring in the field of forest products during the year 1954-55.

The Portland group is associated with the International Order of HOO-HOO and is comprised of lumbermen, foresters, lumber association officers and members of the lumber trade press. Don Andrews of *Crow's Lumber Digest* is currently the president.

The objective of the award is to stimulate interest in the lumber industry and give encouragement to a student desiring to extend his education. A committee of the faculty of the School of Forestry in conjunction with the officers of the HOO-HOO group will screen applicants and select the recipient.

B.S. Troop Joins Teco Lab Staff

Benjamin S. Troop has joined the laboratory staff of the Timber Engineering Company, affiliate of National Lumber Manufacturers Association, according to an announcement by Harry G. Uhl, company president.

A native of Connecticut, Mr. Troop received his undergraduate degree in forestry from the University of Maine in 1941. During World War II, he

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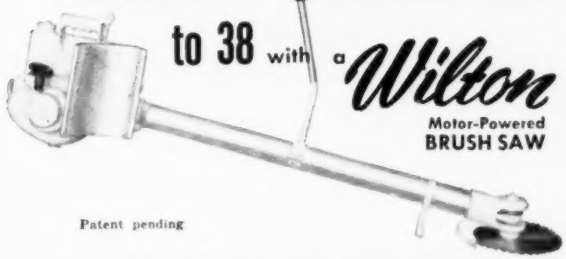

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served in the U. S. Naval Reserve on anti-submarine craft and was released to inactive duty in 1946.

Subsequent to the war, Mr. Troop was employed as assistant to the research forester of the New Hampshire Forestry and Recreation Commission. Then in 1947, he resumed his studies at the Yale Forest School, specializing in wood technology and utilization, and participating as a part-time employee in the tropical woods research program sponsored by Yale and the Office of Naval Research. He received his master's degree from Yale in 1949.

Prior to joining the Timber Engineering Company, Mr. Troop was associated with the Lloyd W. Wise Lumber Co., Inc., wholesale lumber firm of New York City. He is a member of the S.A.F.

N.L.M.A. Reports High Lumber Production for 1953

According to preliminary estimates released by the National Lumber Manufacturers Association, lumber production in 1953 totaled 39.2 billion board feet. This production figure is the highest on record since N.L.M.A. started reporting production figures in 1929. It is 3 percent above 1952 and 1 percent above 1950. Shipments were reported as being 2 percent below production and new orders 3 percent below production.

Products & Equipment

Diesel Locomotion Lengthens Tie Life

Union Pacific officials report that the life of lodgepole pine ties has been increased several years by the switch from steam to diesel locomotives. Ties receive less pounding, is the reason given.

The Bridger National Forest in Wyoming reports that drain on the lodgepole pine tie stands has been reduced by this lengthened life of ties under modern methods of locomotion.

Caterpillar Tractor Co., to Use Products of Atomic Energy

Plans to use the products of atomic energy in research work at Caterpillar Tractor Co. have been announced by J. M. Davies, director of research.

Radioactive materials will be used to accelerate long-time endurance tests on parts, and are expected to give test results not obtainable by more conventional methods. Parts tested will be sent to Oak Ridge to be made radioactive.

"For example," Mr. Davies said, "we might use radioactive materials to test piston ring wear. By running a radioactive ring in an engine we will build up radioactivity in the crankcase oil, thus giving a direct indication of the wear on the ring. We can complete the test with the aid of a Geiger counter."

Caterpillar's first step in working with atomic energy will be to use comparatively low levels of radiation intensity. Tests will be conducted by W. P. Evans of the Caterpillar Research Department, who was sent to the Institute of Nuclear Study, Oak Ridge, Tennessee, to study the handling and use of radioactive materials.

English-Made Machine Makes Leftovers into Hardboard

A new 200-ton, $615,000 machine developed in England converts wood scraps into a continuous panel of fiberboard. It is available from an English firm's New York representative, Aries Fiberboard Corp.

Wood shavings, trim and other forms of cellulose are combined with small quantities of resin, heated, and then put under pressure. What results is four-foot-wide board that looks like lumber, in any thickness from 3/16 to 3/4 of an inch. The manufacturer says the unit in one day in England turned out a single panel more than five miles long.

—From *Forestry Digest*

Belsaw Farmer's Sawmill

The Farmer's Sawmill, manufactured by the Belsaw Machinery Co., 315 Westport Road, Kansas City 11, Mo., will soon be available from farm equipment dealers at a cost of about $395.00.

Belsaw Farmer's Sawmill

The machine is a complete one-man sawmill that can be powered off of any farm tractor and will cut dimension lumber from logs 14 feet in length and 14 inches in diameter. The Farmer's Sawmill is a precision machine that, according to the manufacturer, can turn out 1,000 feet of lumber every day and can save half of building costs by turning out straight dimension lumber for any new farm construction.

Logging Bulletin Available

A recent publication (form D415) which discusses methods for getting timber out of the forests regardless of weather and ground conditions. The eight-page booklet is entitled "Pro-

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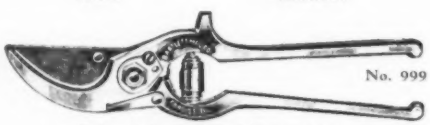

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Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

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Wanted—Assistant to forester on large, undeveloped sub-tropical Southeastern forest; experienced in development and supervision of protection, public relations, and other management practices of that region. Salary $4,200.

Box J, Journal of Forestry, Mills Building, Washington 6, D. C.

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Progressive forester manager of small business desires to relocate. Long experience business manager, logging, milling, forest management. Prefer Lake States. Age 33, excellent references.

Box M, Journal of Forestry, Mills Building, Washington 6, D. C.

ducing Profit in Southern Logging" and may be obtained from any Caterpillar dealer or by writing Caterpillar Tractor Co., Peoria, Ill.

Pressure Pump Bulletin Available

For forest fire fighting and protection around the mill and lumber camp a new lightweight, positive displacement pressure pump with pressures of 250 to 300 pounds is described and illustrated in Bulletin L-807 from the Homelite Corporation, 5404 Riverdale Ave., Port Chester, N. Y. This bulletin outlines construction details and specifications of the new pump and includes a series of photographs illustrating its applications.

Lombard Chain Saw

Features of the new Lombard Model 35 chain saw are: trigger control, direct carburetor connection (no tubes or pipes to dissipate energy), mag-ne-lite parts, close-to-ground cutting, automatic oiler and automatic shut-off, air filter guard and positive chain tightener all promoting ease of handling in wood cutting. A fast, smooth new chain is now standard equipment on the gas-powered saw which is distributed by accredited Lombard distributors only throughout the United States and Canada.

Light-Weight Saw Available

A new low-priced chain saw weighing only 20 pounds complete with blade and chain is announced by McCulloch Motors Corp., Los Angeles. Because of its light weight and ability to saw full power in any position without adjustment, this chain saw is ideal for tree removal, pruning, tree surgery, and many types of heavy construction sawing. The saw is designed to fell trees within one inch of the ground. Features include automatic clutch, automatic rewind starter, all-gear transmission, fully enclosed flywheel, air filter, anti-friction bearings, manual chain oiler, plated blade, handlebars, and muffler, and waterproof Bakelite-encased coil. All parts normally requiring inspection, such as spark plug or points, are easily accessible.

The saw is equipped with a new fast-cutting, narrow-kerf sabertooth chain, and either 12-inch or 16-inch blades. It is powered by a special light-weight McCulloch gasoline engine with three-ring piston, hard-chrome-plated cylinder wall, and deep-finned aluminum-alloy cylinder with removable head.

Index to Advertisers

	Page
Aermotor Company	308
Allis-Chalmers	242
Atkinson, S. Gayley	303
Banzhaf & Co., George	303
Bartlett Mfg. Co.	314
Belsaw Machinery	304
Bernard Food Industries	311
Brady & Associates, Joe H.	310
Calder, Lester E. and Douglas G.	299
Caterpillar Tractor	Back Cover
Central Aircraft	292
Chapman Chemical	Third Cover
Chipman Chemical	293
Council Tool	295
Darley & Co., W. S.	307
Dimension Mill Equipment	302
Drost, Romola	292
duPont Grasselli	300
Eastman, Wm. A.	303
Forest Seeds of California	304
Forestry Suppliers	308
Hale Fire Pump	304
Hall, A. G.	303
Harodikes	299
Hazard, James O.	309
Herbst Bros.	312
Hoffco	295
Kurfew	299
Lemieux, Frank J.	303
Lowther Co., Harry A.	307
Melin Meteorological Service	299
Meriam Co., L. W.	309
Musser Forests	314
Nelson Co.	294
Oregon Saw Chain	302
Pacific Marine Supply	301
Pond & Moyer	303
Prentiss & Carlisle	303
Rich Forest Fire Tool	304
Ronald Press	306
Schultz & Co., C. D.	303
Sebrell Corp., J. B.	311
Sewall Co., James W.	303
Silva	311
Smith, A. R.	292
Smith Co., D. B.	Second Cover
Southern Coatings & Chemical	305
Southern Seed	309
Sunerest Evergreen	311
Twin City Welding & Machine Shop	312
Utility Tool & Body	292
Western Fire Equipment	313
Weyerhaeuser Timber	291
Williams & Hussey	313

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The Society of American Foresters

The Society of American Foresters is a professional organization of technically trained foresters. It is a democratic, nonpolitical, nonprofit association of over 9,000 members.

As stated in its Constitution, the objects of the Society are to represent, advance, and protect the interests and standards of the profession of forestry, to provide a medium for exchange of professional thought, and to promote the science, practice, and standards of forestry in America.

Membership in the Society of American Foresters is recognition of a man's professional abilities and attainments. No person can acquire such recognition if it is not deserved.

The Society is governed by a president, vice president, and nine other Council members. Policies established by the Council are translated into action programs which are administered by the executive secretary whose office is in the Mills Building, Washington, D. C.

An annual meeting of the Society includes technical sessions arranged by the eleven Divisions which specialize in forest management, silviculture, private forestry, forest economics, forest products, forest recreation, forest wildlife management, range management, watershed management, public relations, and education. Other features of the meeting include sessions on general topics and a joint conference of the Council and Section delegates.

Sections are regional units of the Society. The United States, its territories, and Canada are divided into 21 Sections which elect their own officers, hold meetings, and conduct appropriate projects and activities. Many Sections have subsidiary units called Chapters which hold informal meetings and field trips to acquaint foresters with each other and with local forestry matters.

The JOURNAL OF FORESTRY is a monthly publication of the Society. Other publications include *Forest Terminology*, *Fifty Years of Forestry*, *Foresters' Manual* (now in preparation), and others.

Through its publications and meetings the Society provides a medium for the exchange of professional information and promotes cooperation among foresters and with those in allied fields.

By encouraging its members to promote the adoption, use, and improvement of forestry practices, the Society endeavors to extend the benefits of good forestry practices to all timberland owners and users of forest products.

Through the operation of committees, by the functioning of Chapters, Sections, Divisions, and the Council, and by expressions of the membership through referendums, the Society helps establish the policies and standards to be observed by professional foresters.

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Colleges and Universities in the United States Offering Instruction in Forestry

MARCH 1, 1954

Accredited

The following institutions are accredited for forestry instruction by the Council of the Society of American Foresters.

Alabama Polytechnic Institute, Department of Forestry, Auburn, Ala.

University of California, School of Forestry, Berkeley 4, Calif.

Colorado A & M College, School of Forestry and Range Management, Fort Collins, Colo.

Duke University, School of Forestry, Durham, N. C.

University of Florida, School of Forestry, Gainesville, Fla.

University of Georgia, School of Forestry, Athens, Ga.

University of Idaho, College of Forestry, Moscow, Idaho.

Iowa State College, Department of Forestry, Ames, Iowa.

Louisiana State University, School of Forestry, Baton Rouge 3, La.

University of Maine, Department of Forestry, Orono, Maine.

University of Massachusetts, Department of Forestry and Wildlife Management, Amherst, Mass.

Michigan State College, Department of Forestry, East Lansing, Mich.

University of Michigan, Department of Forestry, Ann Arbor, Mich.

University of Minnesota, School of Forestry, St. Paul 1, Minn.

University of Missouri, Department of Forestry, Columbia, Mo.

Montana State University, School of Forestry, Missoula, Mont.

State University of New York, College of Forestry, Syracuse 10, N. Y.

North Carolina State College, School of Forestry, Raleigh, N. C.

Oregon State College, School of Forestry, Corvallis, Oreg.

Pennsylvania State University, Department of Forestry, State College, Pa.

Purdue University, Department of Forestry, Lafayette, Ind.

Utah State Agricultural College, School of Forestry, Range and Wildlife Management, Logan, Utah.

University of Washington, College of Forestry, Seattle 5, Wash.

West Virginia University, Division of Forestry, Morgantown, W. Va.

Yale University, School of Forestry, New Haven 11, Conn.

Not Accredited

The following institutions offer professional and technical curricula in forestry, but do not meet the requirements for accreditation.

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Stephen F. Austin State College, Department of Forestry, Nacogdoches, Tex.

University of Connecticut, Department of Forestry and Wildlife Management, Storrs, Conn.

Harvard University, Harvard Forest, Petersham, Mass.

Louisiana Polytechnic Institute, Department of Forestry, Ruston, La.

Michigan College of Mining and Technology, Department of Forestry, Houghton, Mich.

University of New Hampshire, Department of Forestry, Durham, N. H.

Oklahoma Agricultural and Mechanical College, Department of Forestry, Stillwater, Okla.

University of the South, Forestry Department, Sewanee, Tenn.

Virginia Polytechnic Institute, Department of Biology, Blacksburg, Va.

State College of Washington, Department of Forestry and Range Management, Pullman, Wash.

Introductory, Preforestry, and Specialized Courses

University of Arkansas, Department of Horticulture, Fayetteville, Ark.

Centenary College of Louisiana, Department of Biology, Shreveport, La.

Clemson Agricultural College, Department of Botany, Clemson, S. C.

Cornell University, Department of Conservation, Ithaca, N. Y.

Grand Rapids Junior College, Grand Rapids, Mich.

Humboldt State College, Forestry Department, Arcata, Calif.

Idaho State College, Pocatello, Idaho.

University of Illinois, Department of Forestry, Urbana, Ill.

University of Kentucky, Department of Horticulture, Lexington, Ky.

Lassen Junior College, Division of Vocational Forestry and Lumbering, Susanville, Calif.

University of Maryland, Department of Horticulture, College Park, Md.

Mississippi State College, Department of Forestry, State College, Miss.

John Muir College, Pasadena 3, Calif.

North Dakota Agricultural College, Department of Horticulture and Forestry, Fargo, N. Dak.

North Dakota School of Forestry, Bottineau, N. Dak.

Northwestern State College, Agriculture Department, Natchitoches, La.

Ohio State University, Department of Horticulture and Forestry, Columbus 10, Ohio.

Paul Smith's College, Forestry Department, Paul Smiths, N. Y.

Rutgers University, Department of Forestry, New Brunswick, N. J.

Rutland Junior College, Rutland, Vt.

Superior State College, Botany Department, Superior, Wis.

University of Tennessee, Department of Horticulture and Forestry, Knoxville 16, Tenn.

Texas A & M College, Department of Range and Forestry, College Station, Tex.

University of Vermont, College of Agriculture, Burlington, Vt.

University of Virginia, School of Forestry, Charlottesville, Va.

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